

Aviation Week

and Space Technology

March 20, 1961

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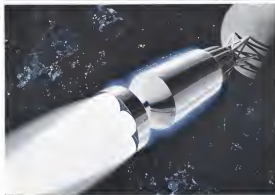
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Turbofans Improve Boeing 720B Performance

NUCLEAR ROCKET PROPULSION AT AEROJET-GENERAL



Nuclear rockets will revolutionize space travel faster than the internal space program. General has been of major interest to Aerojet-General for several years.

Feasibility studies were initiated by Aerojet in 1960 to ascertain the feasibility of nuclear rockets, and the technical advances required to develop a successful nuclear propulsion system were determined. This work at Aerojet has androgenic certain vast expansion under government and company sponsored programs. Included are preliminary design of engines and vehicles, simulated nuclear engine tests, nuclear reactor research, analog computer system design (to simulate nuclear reactor operation), nuclear test facility construction and the design, development, testing, and manufacture of reactors.

These projects have resulted in significant progress toward the development of a practical and reliable nuclear propulsion system. They are based on Aerojet's combined experience in liquid and solid propelled rockets, nuclear technology, and engineering—experience which assures that the challenge of a new era in propulsion can, and will, be met.

Aerojet-General
CORPORATION



A SUBSIDIARY OF THE
GENERAL TIRE AND RUBBER COMPANY



AEROSPACE CORPORATION

present genuine challenge to scientists and engineers of demonstrated competence

"To preserve our free institutions it is absolutely essential that the United States find the most effective means of advancing the science and technology of space and also of applying them to military space systems. This is the mission of Aerospace Corporation."

IRVING J. GUTTENBERG
PRESIDENT
AEROSPACE CORPORATION

In accomplishing its mission, this non-profit public service organization performs the unique role of space systems architect. Aerospace Corporation provides scientific and technical leadership to the civilian/military team responsible for developing complete space and ballistic missile systems on behalf of the United States Air Force.

Specific responsibilities of the new corporation include advanced systems analysis, research and experimentation, initial system engineering, and general technical supervision of new systems through their critical phases.

The broad charter of Aerospace Corporation offers its scientists and engineers more than the usual scope for creative expression and significant achievement—within a stimulating atmosphere of dedication to the public interest.

Aerospace Corporation scientists and engineers are already engaged in a wide variety of specific systems projects and forward research programs under the leadership of civilian/military administration including corporation president Dr. Irving J. Guttenberg, senior vice president Allen F. Denner, and vice presidents Edward J. Burlew, William W. Drake, Jr., Jack H. Irving, and Chalmers W. Shewen.

Aerospace Corporation is currently seeking scientists and engineers capable of solving present challenges and with proven ability in the fields of:

- Space booster project engineering
- Spacecraft design and analysis
- Aerothermodynamics
- Solid rocket research
- Nuclear rocket propulsion
- Ion and plasma propulsion
- Chemical propulsion
- Large scale weapons operations research
- Weapons system reliability planning
- Vehicle control systems

Those qualified and experienced in these and related fields are urged to direct their resumes to:

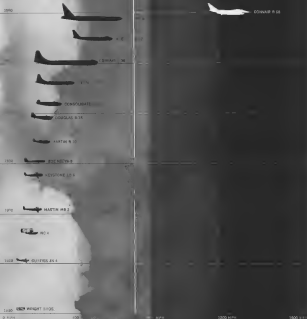
Mr. James M. Browning, Room 101,
P.O. Box 95551, Los Angeles 45, Calif.



AEROSPACE CORPORATION

A new and vital force

engaged in accelerating the advancement of space science and technology



One bomber flies alone on the other side of sound

So fast is the Air Force's B-58 that it could outrun with any other strategic bomber ever known before the other place comes (it's a 100 mph) in less than 10 minutes. The Convair B-58 flies faster than twice as fast as the next fastest bomber already in use.

Already it has also won many other awards.

only could be more, for the B-58 is a young plane. It has been operational only seven months. Fully "grown," it easily could improve its own performance by two percent again.

One place lies clear for the Strategic Air Command and you.

CONVAIR A DIVISION OF GENERAL DYNAMICS CORPORATION
SCIENTIFIC EXCELLENCE — NOTE A SERIES OF MILESTONES

AVIATION CALENDAR

- Mar. 27-31-1961 Symposium on Temperature, Its Measurement and Control in Science and Industry, Columbus, Ohio
Mar. 28-29-National Air Flight Symposium, American Medical Society, Sheraton Hilton Hotel, Dallas, Tex.
Apr. 4-5-Aviation Technician School Admission Conference, Embury University, Lehighville, Ind.
Apr. 4-6-International Symposium on Electroacoustics and Fluid Dynamics of Gases, Plenum, Polytechnic Institute of Brooklyn, Brooklyn, N. Y.
Apr. 4-6-Lifting Rocket Vehicles: Structure, Materials & Design, American Rocket Society, Palo Alto, Calif.
Apr. 4-7-National Automatic Meeting, Society of Automotive Engineers, Commodore Hotel, New York, N. Y.
Apr. 13-Annual Lockheed Meeting and Equipment Exposition, Institute of Environmental Sciences, Park Sheraton Hotel, Washington, D. C.
Apr. 16-21-Space Meeting, Western States Section/The Combustion Institute, Aerospace Division of Ford Motor Co., Newport Beach, Calif.
Apr. 18-14-International Symposium on Astronautics Research and Development, United Nations Agency, Adelaide, City.
Apr. 11-13-Conference on the Ultrasonic System of Semiconductor Materials, Air Force, Cambridge Research Laboratories, Boston, Mass.
Apr. 12-13-14th Annual Spring Technical Conference, Institute of Radio Engineers, American Rocket Society, Hotel Alton, Cincinnati, Ohio.
Apr. 18-14-Annual Meeting, National Aero-

(Continued on page 6)

AVIATION WEEK and Space Technology

March 30, 1961

Vol. 14, No. 12

and space technology. The magazine is devoted to the latest developments in the field of aviation and space technology. It covers a wide range of topics, including aircraft design, engine development, and space exploration. The magazine is published by the Aviation Week Group, which is a leading authority in the field of aviation and space technology. The magazine is a must-read for anyone interested in the latest developments in the field of aviation and space technology.

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AVIATION WEEK, March 20, 1961



now you can choose

In designing digital systems and equipment employing EECO T-Series Transistor Circuits, you now have an extra choice—EECO Magnetic Core Circuits that are both physically and electrically compatible with the EECO T-Series. This new family of compatible magnetic core circuits for the frequency range 0 to 200 Mc includes a huge selection of unit ratings (in single or dual wiring, pulse gates, and more drivers).

ADVANTAGES

The ability of magnetic cores to maintain one or two electric states makes them ideal for logic operations; as counters, a pulse sent through one set of windings will set the core in the "high level" state & pulse sent through another set of windings will reset the core to the "low level" state. Thus you get the logic action with a single core in thousands of cores on the other hand, it is virtually impossible to use the capabilities of each flip-flop.

Core circuits are used to great advantage in our line of shift registers. They offer simplicity and space saving of a factor more than that of an equivalent transistor circuit.

COMPATIBILITY WITH TRANSISTORS

EECO Magnetic Core Circuits are electrically and physically compatible with EECO T-Series Transistor Circuits. They are packaged in T-Series endangers, measuring 1" diameter x 1 1/2" overall height, and they plug into the same standard hole under as the T-Series.



Write now to "phone today for detailed information on EECO Magnetic Core Circuits."
ENGINEERED ELECTRONICS COMPANY
1841 EAST CHERRY AVENUE - SANTA ANA, CALIFORNIA
January 1961

THE CHERRYLOCK TEAM

The Standard Cherrylock
Top Performance Through the
entire range of Diameters, Grips,
and Materials

The Bolted Cherrylock
Specifically for Thin Sheet and
Double Shear Applications—
Even Greater Strength in the
Short Grip Ranges

Only the Cherrylock "2000" Team
Gives you All These Advantages

- Reinforced Locked Stem
- Pull Grip Range
- Pull-in Effects™
- Complete Hole Fill
- No Blowing/Threading
- Positive Visual Inspection
- Positive Sleep-up
- Grip Marked on Head

A-286 Stainless Steel—Monel—Aluminum

The Cherrylock™ "2000" series team offers the finest, most adaptable non-fusefast joint developed. Maximum joint strength and reliability are obtained by using the Standard Cherrylock and the Bolted Cherrylock to cover the entire range of applications. The Bolted Cherrylock for short grips and double shears, the Standard Cherrylock in the longer grip. Both types are installed with the same H405 series pulling head, using existing Cherry guns.

Higher joint strength allowable, close blind side closeness, and the

widest grip range available—only with the Cherrylock Team—result in better fastening at lower cost. The Cherrylock Team provides the strongest mechanical lock—Bolted fasteners most available. Positive visual inspection after installation—with grip length marked on the rivet head—is offered only by the Cherrylock Team.

For technical data on the Cherrylock range of rivets, write Cherry Rivet Division, Townsend Company, Box 1157-N, Santa Ana, Calif.

CHERRY RIVET DIVISION

SANTA ANA, CALIFORNIA

Townsend Company

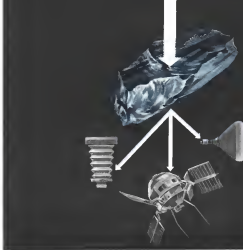
CHRYSLER, GM, & TRANSIT BUS, INC.

In Canada: Formica & Subco Manufacturing Company, Limited, Georgetown, Ontario

AVIATION CALENDAR

(Continued from page 5)

national Space Act, Wash. Wash. D. C.
Apr. 13-14—Institute of the Aerospace Sciences/Army Aviation Meeting (Stennis, Miss., Washington, D. C.)
Apr. 15-16—Individual Conference, International Air Transport Ass., Ottawa Edwards Hotel, Montreal, Canada
Apr. 16-20—Symposium on Chemical Reactions in the Lower and Upper Atmosphere, Stanford Research Institute, Menlo Park, Calif.
Apr. 20—Status Regional Meeting, Institute of Navigation, Sheraton Hotel, Washington, D. C.
Apr. 24-25—General Meeting, American Meteorological Society with the American Geophysical Union, Washington, D. C.
Apr. 25-26—General Meeting and Conference, American Ass. of Airport Engineers, Boulder, Colo., Colorado Springs
Apr. 24-27—Civil Meeting, Aerospace Vehicle Ass., Palmer House, Chicago
Apr. 27—High Temperature Materials Conference, American Institute of Aeronautics and Astronautics, Dayton, Ohio
Apr. 28-30—Liquids, Solids, Gases, and Combustion Conference, American Rocket Society, Palm Beach, Fla.
Apr. 30-May 4—General National Aerospace Instrumentation Symposium, in American Society of Aeronautics, Adolphus Hotel, Toronto, Ont.
May 1-4—Nuclear Components Conference, Institute of Radio Engineers, Jockey Club Hotel, San Francisco, Calif.
May 15-17th—Annual National Forum, Vancouver, Hilton Hotel, Seattle, Wash.
May 18-19—Nuclear Applications in Space Conference, American Rocket Society, Oak Ridge National Laboratory, Oak Ridge, Tenn.
May 18-19—National Aerospace Electronics Conference, IEEE, Miami and Ft. Lauderdale, Fla.
May 19-21—Visual Meeting, Airport Development, Canada Hotel, Vancouver, B.C.
May 21-22—Visual Meeting, Airport Development, Canada Hotel, Vancouver, B.C.
May 22-23—Visual Meeting, Airport Development, Canada Hotel, Vancouver, B.C.
May 23-24—Visual Meeting, Airport Development, Canada Hotel, Vancouver, B.C.
May 24-25—Visual Meeting, Airport Development, Canada Hotel, Vancouver, B.C.
May 25-26—Visual Meeting, Airport Development, Canada Hotel, Vancouver, B.C.
May 26-27—Visual Meeting, Airport Development, Canada Hotel, Vancouver, B.C.
May 27-28—Visual Meeting, Airport Development, Canada Hotel, Vancouver, B.C.
May 28-29—Visual Meeting, Airport Development, Canada Hotel, Vancouver, B.C.
May 29-30—Visual Meeting, Airport Development, Canada Hotel, Vancouver, B.C.
May 30—Visual Meeting, Airport Development, Canada Hotel, Vancouver, B.C.



FAIRCHILD BASIC RESEARCH LABORATORY ADDS A NEW DIMENSION TO PHOTOGRAPHIC CHEMISTRY

New insight regarding the interaction of light with solid state photoconductive surfaces is now being gained at Fairchild's Basic Research Laboratory. Defense Products Division scientists are also discovering new facts about the role of free radicals and molecular complexes in the photographic development process. Such knowledge can produce photographic materials of unprecedented speed and resolution which are capable of virtually instantaneous processing. Another result can be very thin solar cells of wide area and sensitive to radiation from the ultraviolet to the infrared which can be of great value in space exploration. Vastly improved developers can also be fashioned as new data concerning photographic chemistry. This basic and applied research and development is contributing advanced products and techniques for military and industrial applications, assuring Fairchild's continued leadership in the photographic field. The Basic Research Laboratory and its achievements are available for your projects. For a brochure and further information, write the Director of Marketing, Defense Products Division.

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LEADER AND INNOVATOR IN
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Miniaturized cavity-type filter packs 4.2 square inches of filtering area into 1" x 5/8" element

Purolator develops thumb-nail size element to protect hydraulic control circuits on Army's Hawk Missile mobile launcher.

How small can you make an element that meets a 2-gpm hydraulic oil at 2500 psi at any temperature within a 215° range? Purolator's new miniature cavity-type hydraulic filter is the best answer to date. Here's why:

4.2 square inches of convoluted stainless steel wire cloth are packed into this miniature filter. This element, which weighs .623 ounces, filters one gallon per minute of hydraulic oil at temperatures ranging from -40° to +215° F. The element will withstand 2500 psi differential pressure without collapsing.

The element is made up of a mat of 3/16 inch of stainless steel wire, woven into wire cloth and expanded to extend thousand area. This element will remove 98% of all particles whose mean surface dimension are larger than 10 microns, and 90% of all particles measuring 10 microns or more.

The picture at the top of the page shows you the complete filter assembly, ready for installation in the hydraulic control system. The overall length of the unit is 2 1/2", maximum overall diameter is 1". Total weight is slightly over a ounce. Designed in a cavity-type unit, the filter is installed simply by inserting it into the hydraulic system in the filter element outcrops all flow. The element can be removed, cleaned and replaced without special tools.

The picture at right shows the mobile launching platform for the Hawk Missile. The compactness and reliability of the



launcher, and the probability that it would be subjected to severe jolting, made it necessary to specify a filter as small as possible, and one that could be integrated with the rest of the system for maximum simplicity and durability.

The Purolator engineers who developed this new miniature cavity-type filter are available now to design a filter to meet your specifications. Simply contact Purolator Products, Inc., Department 306B, Rahway, New Jersey.

Education for Entry-Grade Fluid

PUROLATOR

PRODUCTS, INC.

ROCKY HILL, NEW JERSEY AND TORRINGTON, CONNECTICUT BRANCHES

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GM HARRISON KEEPS GRUMMAN MOHAWK HUMMIN'



Typical Harrison forced plate-fin type radiator oil cooler



Harrison heat exchangers—quality products of General Motors Research and Development—offer high reliability for aircraft, space and mobile applications



Harrison Heat Exchangers Cool Engine Oil for All-Weather Turbine-Powered Observation Plane

Day or night, in any kind of weather, the Army can rely on the Mohawk—with its visual, photo, radar, or infrared equipment—to observe hostile areas and locate missile targets. And this high performance aircraft, powered by two Lycoming T-55-L3 turbine engines, relies on Harrison heat exchangers to keep oil temperatures under surveillance. Harrison's brand of reliability—"measurable confidence"—results from an "aircraft design to end use" concept which makes Harrison heat transfer products perform as intended—ensuring complete dependability and peak efficiency under the most severe operating conditions. This reliability is built right into every one of Harrison's 15 basic types of heat transfer construction—a complete line of designs, incidentally, which permits the selectivity that assures the right heat exchanger for every application. To save time and money on your temperature control problems—and to get a reliable solution—call in a Harrison Sales Engineer at the design stage.

Free For an informative 48-page brochure on the complete Harrison line... write to Department 902

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AIRCRAFT, AUTOMOTIVE, MARINE AND INDUSTRIAL HEAT EXCHANGERS

HARRISON RADIATOR DIVISION, GENERAL MOTORS CORPORATION, LOCKPORT, NEW YORK

BELL PROVES

GLOBAL FLIGHT RELIABILITY

- More than 55,000 miles-plus, without major ground support
- 3,600 take-offs, from sea level to 19,700 feet
- 750 hours of punishing demonstration flight
- Only minutes of daily flight-line maintenance
- More than 12,000 passengers, plus cargo, in 16 countries

There's a lot more than meets the eye in claiming helicopter maintenance dependability. You must prove your claim, and Bell helicopters have done just that during these world-wide demonstration tours... mostly in areas devoid of helicopter support facilities. The statistics compiled by Bell's Models 204B, 473-B and 470-C during this extensive flight program tell a story of maintenance dependability and scope of operation unequaled in helicopter flight.

Military light helicopter flight requires that same reliability... that same capability of performing independent of support wherever and whenever the mission demands. Combat success in modern warfare relies on the readiness and reliability of front-line equipment... in the front-line environment, Bell has proven its claim to mission reliability.

For Proven Flight Reliability... Look to BELL.



**BELL HELICOPTER
COMPANY** (NYSE: BEL)

• A DIVISION OF BELL AIRCRAFT CORPORATION • A TYSON COMPANY

USA-190-2948



MISSION BELL ACCOMPLISHED



From the largest to the fastest of pilotless aircraft

Sperry "flies" them all

The highest levels of performance and reliability in pilotless flight are currently being attained at Sperry Phoenix. Working with the Department of Defense and in cooperation with other leading Army and Air Force contractors, Sperry has played a major role in "demonstrating" virtually every type of airborne vehicle.

Soon the Lockheed F-104 — with a special Sperry drone stabilization and control system — will fly precision, unattended missions for the U.S. Air Force at double-sonic speed and altitudes of 60,000 feet and above. It is the

fastest of pilotless aircraft, just as the Sperry-equipped QF-47 is the largest. To meet the Army's difficult battlefield surveillance mission, Aerojet-General's SD-2 reconnaissance drone also employs Sperry stabilization and control.

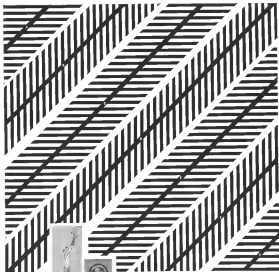
No argument here had more experience in drone control than Sperry. Beginning with the first aerial target in 1913, this experience covers a wide spectrum, including QF-17, QF-46, SD-2, QF-47 and QF-101. Sperry Phoenix now is delivering to USAF a revolutionary Mission Command Guidance System

permitting precision remote control of many types of pilotless craft over hundreds of miles.

Sperry's pilotless flight capability encompasses both components and complete systems... points to a host of new applications... including the defense and even the leisure—spacecraft and rocket-launcher recovery.

SPERRY

SPERRY PHOENIX COMPANY, DIVISION OF SPERRY RAND CORPORATION PHOENIX, ARIZONA



Business & The Environment



At Hitemp—Quality is not an illusion



Pick up and examine several different brands of wire and cable. Almost identical, aren't they? Their similarity with regard to quality, however, is just as much an illusion as the art here above.

Although similar materials and equipment may be used in making all brands of wire and cable, one brand—Hitemp—will outlast, outperform the others.

Idle chest thumping? No! Hitemp has the greatest share of experience in the industry—two modern production facilities that are second to none—and more than one-fourth



of its entire work force devoted solely to inspection and quality control.

Hitemp products are for you, the wire and cable user who requires quality and reliability that is fact, not illusion.

Hitemp is a Division of Simplex Wire & Cable Co.

HITEMP WIRES CO.

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Free engineers for creative assignments with the new low-cost IBM 1620

The new 1620 Data Processing System is a low-cost solution to the problem of freeing engineers for their most creative and profitable assignments. Here's why.

EASY TO USE—Just a two-day training class is all you need to put your 1620 into operation. This means no delays in learning to use the 1620 computer.

In addition, you get a wide range of free programming services including FORTRAN and GORTAN. FORTRAN is the powerful scientific language that lets you solve problems without writing detailed computer instructions. GORTAN is a simplified language (a subset of FORTRAN) that lets you enter simplified problem statements and data into

the computer with the solution immediately available, in one single operation. **FAST**—The 1620 solves a set of ten simultaneous equations in only 20 seconds. It inverts a 10 x 10 matrix in just 62 seconds.

POWERFUL—The 1620 inverts a 60 x 60 matrix. With optional additional core storage the 1620 can handle matrix inversion problems of a much higher magnitude.

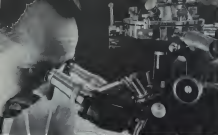
KEY FULL DETAILS—The 1620 is the most outstanding engineering and scientific computer in its price range. A basic installation costs for just \$1,600 a month.

To learn how the 1620 can free you for more creative engineering work, call your local IBM representative.



IBM's 1620 is a compact data processing computer.

IBM
DATA PROCESSING



Extremely high temperature material problems encountered in re-entry into earth's atmosphere are studied with the aid of a plasma jet capable of 30,000°F.

Beneficial effects of elevated temperatures on various materials are viewed and photographed with the hot stage microscope.



Advanced type of primary and emergency fluid power supply system developed and built by Vickers being readied for feasibility test on a simulated aircraft chamber.

CAPABILITY is spelled r-e-s-e-a-r-c-h

In technology and facility, Vickers continually matches your needs

New fluid power and hot gas systems for aerospace vehicles still in the idea stage are being developed at Vickers. Techniques for converting basic energy into precisely controlled power are continuously being sought by experienced teams of research specialists utilizing the finest scientific equipment.

Creative application of the sciences of hydrodynamics, aerothermodynamics, heat transfer, metallurgy and chemistry have been productively blended with Vickers vast experience in the instrumentation and control fields.

The principal effort of Vickers applied research is now concentrated in three areas: 1. advanced systems and components for altitude controls, 2. secondary rocket nozzle injection and 3. hot gas servo actuators. In addition, continuous refinements are being made to the high performance Vickers hydraulic pumps and motors.

The experienced Vickers Application Engineer in your area will welcome the opportunity to fill you in on additional details. In the meantime, write or call for Bulletin A-6002.

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POWER TRANSMISSION • ENERGY CONVERSION

Analysis of fluids, propellants and gases and control of electronic equipment is carried out in a completely equipped chemistry laboratory.

Analog computer (shown) and solid state Univac digital computer give Vickers the important edge in solving complex engineering problems.

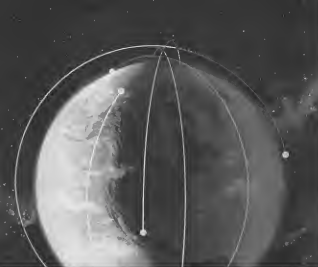


March 25, 1961

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Midas satellites: our infrared eyes in space

Should enemy missile ever be launched against America, they would plunge down upon us in just thirty minutes. They would be halfway here before the first warning blip showed up on our earthbound radar screens. But our Midas satellites will warn us within seconds. Their infrared eyes will "see" any missile's white hot exhaust as soon as it leaves the earth's atmosphere, over thousands of miles distant. Just a few of these satellites, circling the earth on pole-to-pole orbits, will be enough to keep every acre of land and sea under constant surveillance. By doubling our warning time, Midas will give us precious extra minutes to get our long-range bombers off the ground and our intercontinental missiles ready to launch—and thus render futile any hope of destroying our military might with one bold stroke. Midas will become a reality years sooner because it is based on the Agena satellite which Lockheed developed for the first blazing Discoverer program of the U. S. Air Force. Lockheed is now building Midas satellites for the Air Force at "Satellite Center, U. S. A."—its Missiles & Space Division at Sunnyvale, California.

LOCKHEED

MISSILES & SPACE DIVISION, SUNNYVALE, CALIFORNIA

EDITORIAL

New Space Power Program Needed

For several years, we have lapsed with increasing vigor in a farcical, carry-line dispute by the top technical spokesmen of the government to plot away the critical significance of the widening gap between U. S. and Russian rocket engine power. This theme, thrust with regularity by such spokesmen as Neil McIlroy, Herbert York, George Kozlovsky and Keith Clemens, maintained that the Soviet rocket supermen had little technical significance because we had "just enough thrust" to haul the overhead of early model Atlas ICBMs over the simplest ballistic trajectory between U. S. bases and Soviet targets.

This explanation was used to explain their persistent veto of any attempts by the military and industry to develop significantly larger rocket engines, and also to generate an air of public complacency with the grossly inadequate space power development program then being sponsored.

This program is aimed at creating a U. S. capability in 1965 which will duplicate what the Soviets are doing now.

The "just enough thrust" fallacy has no validity even in the ICBM area, where it was used most often to pass, and then veto, powerplant proposals and to patch post-mortem. For the purpose of this polemic, we will ignore this aspect of the argument on how much thrust is in fact required in ICBMs for increased warhead weight for use of multi-bomb warheads and for carrying decoys and using flight tactics that outwit defense computer work based on the simplest ballistic trajectory between launch site and target.

Fallacy in Space

For it is in the area of space technology that this fallacy is bearing its most serious consequences and has endangered the United States to a space program far below its genuine technical capability, and far short of its competitive requirements. The most powerful booster now being developed in the ICBM program are not sufficiently powerful to haul the Dyno-Sov advanced space vehicle into orbit. Nor can the Atlas ICBM engines now being used with the Saturn space reconnaissance system launch all of the reconnaissance equipment desired in that orbital package. The system, along with others, will suffer greatly reduced military capability for some time due to the "just enough thrust" complacency that stultify Messrs. McIlroy, York, Keith, Kozlovsky and Clemens.

We were equally impatient with the ultra-conservative, badly-budgeted original NASA booster program that was repeatedly defeated by its sponsors before Congress and in public speeches with incredible complacency as a program that admittedly would only equal the current Soviet space payload capability some time or the year hence.

Thus, it was refreshing to listen to the industry spokesmen who recently appeared before the House Committee on Science and Astronautics (see p. 20 and AW Mar. 13, p. 307) with specific technical plans offering the hope of outstripping and surpassing Soviet capabilities in the same period when the old NASA program miserably aimed at equalling the 1960-61 Soviet performance. It is also encouraging to note the technically sound and critical approach to this glaring weakness in our national technology taken by the Wiesner report to President Kennedy (AW Jan. 23, p. 79) and the USAF Space Advisory Group headed by Thomas Gordon. Even more encouraging is the behind-the-scenes strong action NASA and USAF to organize a new national rocket booster program aimed at fully exploiting the scientific and industrial resources available in this critical area.

Unrealized Technical Capability

The program outlined in the House space committee, even allowing for the normal percentage of industry overcommitment, showed clearly that the technical capabilities of the nation in space power development are far in excess of what the planners who have been running the national space program have recognized.

It should be evident now, both to Congress and to the executive branch of the government, that a basic new power development program to meet both military and scientific requirements of space technology, is most urgently needed.

As the industry spokesmen before the House space committee emphasized, this program can serve to useful purpose if it is aimed at meeting tomorrow's requirements tomorrow. It must be aimed at putting the entire spectrum of space powerplant development in its full potential as far as possible without waiting for specific requirements to appear in either military or civil space programs.

The powerplant has always been one of the longest lead time areas in any weapon system development program. The policy of tying powerplant development to specific weapon systems has inevitably resulted in the curbed production of an underpowered vehicle. It is about time that this better known is learned thoroughly, and that the national space booster program acts its might high enough so that when requirements for specific space vehicles emerge, they will find a full branch of adequate powerplants coming along in the development cycle, ready for speedy application to their specific problems.

If the promised dynamism of the Kennedy Administration are to be translated into specific action that will establish an unquestionable hallmark of technical superiority for this country, a new national space power program offers an incontestable and significant opportunity.

—Robert Hertz

IMPROVEMENT

The AMPHENOL Poke "R" connector provides users with a specially designed MIL-C-5015-type connector. Through the employment of the AMPHENOL-developed Poke Wire contact concept, Poke "R" contacts are crimped outside the connector, insulated and then inserted. Contacts may be removed from the connector at any time for replacement or re-wiring. The reliability of crimping, the accuracy of inspection and the speed of assembly all measure the improvement of Poke "R" over standard MIL connectors.

Surpassing MIL-C-5015, connectors also meet the tough altitude-moisture resistance "bucket" test. In other respects, Poke "R" connectors are similar to MIL-C-5015 "R" types.

29 inserts in 3 shell styles are available in the Poke "R" family. Catalog data is available for your use.

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CONNECTORS

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WHO'S WHERE

In the Front Office

Harold J. Berry, a director of United Aircraft Corp., East Hartford, Conn., is placing Joseph P. Ryles, vice president, Mr. Berry is vice president and a director of Hercules Supply & Co.

Richard M. Mack, a director of Dayco Corp., Allentown, N. Y. Mr. Mack is chairman of the Executive Committee of Dayco.

Wyle Laboratories, El Segundo, Calif., has elected the following for additional duty and vice president of Wyle Laboratories & Co. Inc., Richard W. Jones, managing partner of Matichon, Jones & Thompson; Robert J. Gurney, vice president and general manager; and Henry E. Kautz, vice president field engineering and contracts. Wyle Laboratories.

Nicholas Drizina, a director of McDonnell Aircraft Corp., St. Louis, Mo. Mr. Drizina is McDonnell's vice president finance.

Edgar F. Gore, a director of Hamilton Precision Services, Inc., Kennesaw, Ga. Mr. Gore is president of Norton Co.

Henry G. Rosen and Herbert A. Cohen, directors of United States Corp., Washington, D. C. Mr. Rosen is general manager of Technology International Corporation of Aeronautics and Mr. Cohen is manager of VITA, Space Instrumentation Division.

Edward H. DeCasta, president of Taylor Flow Co., Sarasota, Fla., is replacing John M. Taylor, Jr., new board chairman. John A. Latham, Jr., president of Robert Turck Corp., Wilkes-Barre, Pa. and Richard H. Hoffmann, Jr., board chair man.

John E. Roeder, a vice president and general manager, North American Aviation Inc., Los Angeles, Calif., and Harold B. Ringle, senior counsel to the directors and the president to special projects.

William A. Reger, a vice president, Renshaw & Lusk Inc., Rockville, N. Y. Mr. Reger continues as manager of the Military Products Division.

Dr. Vincent A. Meron, vice president, Aerobic Corp., Cambridge, Mass.

August Meyer, vice president engineering for special products, Alcatraz Missile Products Co., Inc., Los Angeles, Calif.

Gaorge B. Shaw, a vice president of ACS Industries, Inc., Mr. Shaw continues as general manager of the ACS Electronics Division, Rockville, Md.

A. N. Kuchman, vice president-engineering, Arnold Corp., Worcester, Ind. and H. M. Handman, vice president and general sales manager.

Frank Nibbel, executive vice president, Hewlett-Packard Corp., Los Angeles, Calif. and Richard A. Fazio, vice president and general manager, Bosch Laboratories, Inc., Farmville, Va.

Caesella M. Shaw, Jr., head of Vespene Operations for the Defense Systems Division of General Motors Corp., Santa Ana, Calif.

Col. Thomas M. Cooke, commander of Redstone Arsenal, Ala.

(Continued on page 100)

INDUSTRY OBSERVER

Among techniques Air Force Ballistic Missile Division is considering for use in Trajectory Vector control points for detecting nuclear explosions in space are very low frequency pulses, visible light, backscatter from radar, cosmic noise and absorption and fluorescence in the atmosphere.

Investigation of basic design requirements of a manned spacecraft capable of maneuvering to earth after a soft lunar landing is planned by NASA's Marshall Space Flight Center. The mission will stress weight, size and launch thrust requirements.

Third and fourth Triad aircraft will carry two wide-angle television cameras instead of the conventional one, a wide-angle and a narrow-angle camera in Triad III. All other equipment will be the same as in Triad II. NASA says the narrow-angle camera has been eliminated because meteorologists felt that they can get more useful data with the two wide-angle cameras.

Cesium Fluoride will just the effects of nuclear radiation on her type of fuel at -423° represents the temperature of solid liquid hydrogen which will be the working fluid for nuclear rocket propulsion systems. Two stainless steel slabs, a titanium alloy and an aluminum alloy will be used as the test.

New Bureau of Weapons is developing the Mark 46 anti-submarine torpedo to advance the speed limit to 500 ft. per sec. for launching these weapons. Mark 46 is developed in a penultimate, which discharges before the torpedo hits the water. Prototypes have been fitted in ships over both water and land to check performance and aerodynamic and hydrodynamic characteristics.

Techniques for improving survivability of tactical satellite aircraft, such as the Republic F-105, will be evaluated by Air Force in its analysis of penetration and proposals submitted by about 15 companies in a competitive for two study contracts.

Keyboards will test deflection angles and penetration abilities of various radio frequencies under Air Research and Development Command's Project Coda, for communications zone subsector. Nine test items conducting actual tests in the very low frequency range with a page-book experiment attached to Triad III.

Full Helicopters is negotiating with NASA for conversion of its XV-3 subsonic VTOL/STOL, tested in turbine power, with the Locomotion T39 replacing the current Pratt & Whitney R985 piston engine. The turbine-powered XV-3 probably would provide NASA with much data for use in the turbine VTOL program (AW Feb. 27, p. 33).

Ballistic Missile Division is expected to choose a contractor sometime after April for outfitting three ships with optical and radar tracking equipment and communications gear for Atlantic Missile Range. Ships will receive upgrades of on-board ballistic missile, along with signal tracking devices. Building components include Acoustic Guided Systems, Alpha Corp., RCA, Sperry Gyroscope and Sperry Technology Laboratories.

NASA Lewis Research Center's new accelerator has been operated 10 hr. to date, using mercury vapor as the working gas. A laboratory model of a system that could be used in an electric rocket engine, the accelerator develops 601 ft. of thrust, or 2.5 hp., with an estimated efficiency of 87%.

Observing solar observatory (OSO), scheduled to be launched by NASA next month with a Delta vehicle, will weigh 415 lb. The observatory's stabilizing inertia wheels will spin at 30 rpm., and its solar cells will generate 25 watts.

Columbia University's Hudson Laboratory is contributing to development of new data processing techniques for Navy's Ardent active sensor anti-submarine warfare system.

To recall a bullet 22,000 miles away



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THE R-70 MATO major system management contract places in the hands of a single contractor, Motorola, an unprecedented responsibility: positive recall of a Mach 3, nuclear detection force. At speeds over 3,000 mph—faster than a rifle bullet—over and over safety, as well as mission success, demand integration of myriad electronic functions with simplified controls and displays. The integrated MATO system includes the functions of worldwide command communications (LBR) linked to the SAC Command Network; line-of-sight, short-range communications (SRG), improved tactical air navigation aids (TACAN), air-by-air (IFF), air-by-ground (IFF), aerospace ground support equipment (AGE), air-to-air rendezvous equipment (instrument landing system (ILS) and crew intercommunications. ♦ Motorola's role as a major electronic system contractor for the R-70 Valkyrie's Mission and Traffic Control typifies its systems management capabilities. Detailed information is available on request.

Military Electronics Division



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Washington Roundup

Progress Payments

Defense Department now will make full progress payments on cost-plus-fixed-fee contracts exceeding the 50% ceiling imposed in 1957 by the Eisenhower Administration. The new rule will apply to all future contracts and present contractors can start getting the 50% increase without all the onerous conditions that have been the Defense estimate that \$175 million could be released if contractors take the step.

Portage apparently made the change last week to both Congress. There was a strong chance the change would be with a veto law if Defense didn't move fast.

Cost reduction and procurement simplification were the official reasons given for the move. The rule was a hangover from the 1957 economy drive in which then Defense Secretary Charles Wilson imposed stringent limits on progress payments. These were eased somewhat when his successor, Neil McMillan, set the 50% ceiling. Now Defense wants to move to eliminate the extra cost of contracts awarded from industry borrowing to finance the 50% outlay, which is considered in setting a contract fee.

Progress payment rolling was rescinded by Deputy Defense Secretary Russell Galpin, assistant of the assistant chief of staff, Mr. Robert S. McNamara's personal aide, to establish for himself as the Portage.

The additional rule is further emphasized in the McNamara memorandum giving the Air Force primary responsibility for under space programs. It says "The Defense Secretary and I" intend to make the move and it goes the term "we" in explaining the decision.

Galpin also noted the order to the service but work to increase defense contracting to small business. Goal was to increase fiscal 1962 small business contracting 10% over the \$1.4 billion in fiscal 1960.

Space Probe Blunted

Scope of the House space committee investigation of the Defense order giving major space responsibility to USAF has been narrowed to the effect of the directive as National Aeronautics and Space Administration. The original aim was to explore the full effect of the directive.

A shortage of top Defense officials developed when the committee began to probe whether to include. Deputy Defense Secretary Galpin, asked to appear and explain the move, but a week of traveling kept other top officials from appearing, leaving the committee with a roster of second civilian defense executives.

Strong pressures apparently were brought to bear, both on the committee and on Pentagon officials, to avoid a controversial probe. Committee Chairman Charles McNamara considered naming subcommittees to create a response from the top officials; the group voted to question.

White House is increasingly emphasizing information on transportation, and commercial aviation may become a major focus policy tool. The Administration has that already done, it provided a major concern to support more advanced U.S. airline operations, particularly in remote areas where service is limited. After probably will be the first target in this effort.

Life Sciences Review

Top NASA officials conducted a review of the agency's environmental life sciences research plans late last week to prepare for some kind of questioning on the subject when the House space committee returns January 22. The review was made by NASA Administrator James Webb, Deputy Administrator Dr. Hugh Dryden, Associate Administrator Robert S. McNamara and Life Sciences Director Clark R. Kopp.

Space agency officials are now duplicating other life sciences work and that the scientists will be grouped with the pattern that currently exists. NASA also is plans to encourage as well as military groups for assistance in its space research programs.

Major reorganization of the office of defense director of research and engineering is complete. Army Lt. Gen. William P. Fowler, the new assistant director for the Weapons Systems Evaluation Group. John E. Macdonald is special assistant for foreign programs and Alan G. Waggoner is special assistant for space.

Non-profit organizations connected with the Defense Department will explain their policies and policies to the House committee next month. House Armed Services Special Investigations Subcommittee, headed by Rep. F. Edward Hebert, will review nonprofit firms handling Defense research and development. House space committee will question all groups of this type doing business with the government.

President Kennedy said last week that he is looking into the disparity between salaries paid scientific personnel by non-profit organizations and those paid comparable civil service personnel. But he refused to take a stand on the issue.

—Washington Staff

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Carrier Communications Satellite Studied

Los Angeles—June commercial com-
munications satellite business contract,
winning the nation's largest com-
munications contract, is being awarded to
the nation's largest satellite communications
company, Hughes Aircraft Co., for a five-
year development period, it was an-
nounced today by the General Elec-
tronics and Electronics, RCA Cos.
Communications and Lockheed Martin
Space Division. Intended as a
"demonstration" project, the work contract
would have channel capacity for more
than one million telephone, teletype
and radio to conventional communications
lines.

Another major carrier, International Telephone and Telegraph Corp., is reported considering the joint venture plan, proposed with this war in London, and may enter the preliminary study. The latter proposal is an outgrowth of an extensive scientific research planning study of a fifteen-nation article. (Official review conducted for the specific manufacturing by the management consulting firm of Booz Allen & Hamilton.) Additional political and regulatory aspects of the Treaty are being explored in a supplemental study by the Washington legal firm of Fennemil & Thayer.

Ross, Fox & Lammiman suggest financing for the intrinsic growth from U & S telecommunications companies. This form of financing currently has been proposed for the telecommunications industry, but it is not clear how much of the industry's growth can be financed in this way. The telecommunications industry is expected to grow at 20% to 25% annually, and the industry's capital requirements are expected to be \$100 billion to \$150 billion annually. The telecommunications industry is expected to be a major source of capital for the telecommunications industry, but it is not clear how much of the industry's growth can be financed in this way. The telecommunications industry is expected to be a major source of capital for the telecommunications industry, but it is not clear how much of the industry's growth can be financed in this way.

Lockhead is anxious to get the operation under way but is believed to prefer to hold out as sufficient large an interest in the joint venture enterprise as necessary to show its good faith since it is not a former staff. Industry sources say the company is seeking participation by at least one additional major technology firm.

Whether the venture is actually begun, let alone successful, may hinge on the attitude toward it of American Telephone and Telegraph Corp., the sole U.S. carrier of intercontinental telephone traffic. AT&T has been opposed to the Lockheed plan. It is pushing its own plans for a low-orbiting commercial communications satellite project for which it had Federal

Communications Commission authorization to conduct a one-year experiment (AW Jan 23, p. 18)

A deluge of A&T severance and layoff notices on Bell Telephone Labor contracts at Warner Hill and Whappan, N.J., north of New Canaan and Denville, in Southern California this month are to measure those availability of untold, lunch-rehearsal for its progress. Industry insiders sympathetic to the Lockheed "Silent plan" as the present model is a "terrace without A&T" atmosphere, but predict that this will be forthcoming if the Lockheed plan progresses beyond the preliminary stage phase and if it gains corporate support among telegraph and radio carriers.

Participation of the super-carry could be almost ensured, the Boao, Allen planning study considers to give some commitments for channel banks, in order to obtaining agreements with foreign carriers and to provide actual communication experience.

Factors of the Tishman system could be to serve as an interim link, relaying information primarily from the North Atlantic to the European continent and vice versa. It could also provide long-distance land communications. Its role could be that of a connecting element to a "common" transatlantic, offshore linking circuit to all voice and record telegraph and telecommunication for oceanic message transmission to satellites. The satellite communication would be diversified through existing ground networks, now in use, and in case this system would require a major start-up and would be subject to FCC evaluation.

The proposed Tuckers Creek study straddles an unusual use of one stream, with a large hatchery in an equatorial wet at roughly 22,300 m; a brook, growing in a mountainous forest to the north of the hatchery, and another brook, growing in a mountainous forest to the south of the hatchery.

Centaur Mating

Cape Canaveral-Costar ships were entered vertically last week for the first time with its modified Afterside. It was used in the first systems checkout of the new Complex 36 line with the complete Afterside-Costar vehicle. The Costar-Costar stage was complete with two Pratt & Whitney J4115 engines, but it is not the stage designated to make the first Costar flight.

something later over the Pacific. There will be three or four test lineups during deployment. The previous was expected to be finished to be tested in 1999. So, but the House, AFSS report indicates this would be capable of providing 1,000 two-way voice channels or more by 1997.

During the R&D period, spaceborne equipment will be developed, and communications link analyses and modeling and multiplexing studies will be conducted. Anticipated payload satellite power will be less than two watts at frequencies between 1,000 and 10,000 mc. Communications bandwidths will be somewhere between 50 mc and 300 mc, depending on the modulator technology finally selected.

Velocities suitable for putting the payload into the 22 500-m/s orbit would involve a modified Lockheed Agave C, the basic version of which is in the design stages, and the Carrier C12 from, according to Boom, Allen.

Cost of the initial program, it means separate investments are needed include \$14.7 million for RAD, \$42.8 million for computerization and \$41.94 million for laboratory, clerical, and postoffice, \$77.4 million for modifications to base and launch equipment, construction and construction of 23 transmitting and receiving stations near major command centers of the world, base of Guam, is the greatest pillar of the U.S. Another \$170 million, plus other miscellaneous, would be needed for satellite communications through 1990. The base, also, study indicates that the system should be made available to the

While the Dornier Atlas study says the low-altitude satellite system may be currently more practical, the unknown system—which was favored in space communications' birth fled with the FCC to Radio Corp. of America, Hughes Aircraft Co., General Telephone and Electronics as well as Lockheed—could have these advantages:

• **Flexibility**—These satellites could provide continuous accurate recommendations for 95% of the earth's surface without delay or interruptions because of the availability of the satellite or of resources from satellite to satellite.

*Low interference-Southwestern position would be a source of less interference with surface waterways and airborne vehicles is controversial from among (AW Feb 5, p. 78)

• **Cost**—Is the long-term, the stationary system will be less expensive, although the low-orbiting satellites are cheaper on a unit-for-unit basis. The stationary system would require fewer satellites, less complex and fewer ground stations.



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Turbofan-Pow

Turbofan-Powered B-52H Makes First Flight

First production Boeing 737H is undergoing initial flight tests of Boeing Aerospace Co.'s Wichita, Kan. Division prior to delivery to Strategic Air Command's 198th Strategic Wing, Barksdale AFB, Mich., in May. Structural changes reducing weight and permitting increased fuel storage in addition to use of new Pratt & Whitney TF 33 turbofan engines provide important gains in extended range into the entire B-72C model's 4,000-nm range. Engines are still under the 737H's TF 33 fan engine.

provide a fuel consumption at least 10% lower than the conventional PAV 377 two-floors fitted to urban models at cruise levels in addition to giving a benefit that was 30% higher, eliminating the need for water injection on heavily Takraf Street urban

of the TT 51 is 17 000 lb at sea level and full static conditions. The B-57H wing structure, especially its support systems, are classified secret, although drawings are the same. The fuel system is an American Electric AN/ASG-18. Pilot cockpit instruments

presentation is viewed for greater efficiency—new attitude and positive perception. For example, is integrated providing two instant event focus or place of the focus on. Case weight of the B12H is material over the

A SIG-300R is, although the figure is still small. An important addition to the R72R weapons is the new solid-propellant powered Douglas GAM-87A Stunner missile (AW Ins. 38, p. 15), at least four of which are to be carried externally on pilot launchers under Superfortress wings.



Soviets Predict First Manned Flight On Basis of Sputnik IX Recovery

Moscow-Soviet sources, commenting on their successful fourth biological satellite experiment, are confidently predicting that a Russian cosmonaut will make the first manned space flight.

Sputnik IX was launched and recovered May 9 (AWM May 11, p. 105) with its payload of a four-year-old dog, guinea pigs, black mice, insects and plant seeds.

Soviet Premier Nikita Khrushchev, at an agricultural conference in Siberia last week, said Russia is confident that the time is not too far off when the first spaceship with a man aboard will dash into outer space.

Sovietly commentaries stress a similar belief although predictions include the usual reservation that a Soviet man will not be launched until it is safe that with the U. S. planning to launch a Mercury pilot on a ballistic flight next month and to fly a manned orbital mission before the end of the year, Soviet scientists are now putting emphasis on the importance of Russian manned flight rather than on problems which must be solved.

Kh. Kharlovich of the Armenian Academy of Sciences and Soviet scientists are fully aware of their great responsibility on the eve of manned space flight and are deeply convinced that first space travel will be made by Soviet man.

Soviet press reports said that the main purpose of Sputnik IX was proving out "simplest facilities called upon to assure an earthly cabin conditions necessary for normal activity of organisms in manned space flight." The recovered cabin carried a female dog, called Chermishka, who survived the flight with no abnormal deviations.

Flight was made during a period of increased outdoor activity, according to Vyacheslav Brudnyak, a director of research. He and the "dog" bring weight of the Soviet vehicle (10,140 lb.) makes the entire group to be heavy and strong enough to afford protection against meteoric impact.

Brudnyak indicated the outer structure of the orbital vehicle was devoted to communications aspects.

The payload selected an anticipated

number of times between the altitudes of 1946 and 214 mi., and the Russians say it was exposed to "intense ionization of solar and cosmic radiation." This statement would be disputed by U. S. scientists, who maintain that radiation is not hazardous at these low altitudes.

Soviet Academy of Sciences and the flight and payload environmental conditions were normal. The dogs because was recovered by jetsmen. Cabin temperature varied between 43°F and 48°F, and humidity ranged from 17 to 40%.

Data from Chermishka and members of the previous flight—Belka and Strelka—will be used to determine the effects of acceleration, deceleration and weightlessness on man and other members of man, according to P. Vinn, member of the Academy of Medical Sciences. He said scientists have obtained "interesting information about the effects of unusual stresses on living organisms—ranging also at rocket engines, ball bearings" and loads.

Dogs Preferred to Apes

Vinn and Russian press, using dogs to apes in experiments because dogs remain calm while apes are nervous and more tractable. The U. S. uses monkeys and chimpanzees as space experimental animals because they have the same organ responses and placement as man.

Disappointing a not lack of public comments among Soviet scientists, Pravda published several stories aimed at dispelling earlier misgivings on the success of the manned flight.

Ist. Mirov, director of the Soviet Experimental Biology Institute, said it is not clear "what confidence" man can safely take during launch, reentry, and landing nor it is conclusive that weightlessness is not dangerous.

Koslovich said further improvements in radio, television and television are important for success in biological research. Ukrainian Academician Nikolai Blumkin, said that a series of animal experiments on short and extended orbital flights is under way to clear "unanswerable questions that have to be disposed of before man goes into space here."

Dr. Stanislav Lukash of Hungary, medical adviser of the Union of Teachers and Scientific Associations, said the U. S. is keeping "very much behind the Soviet cosmonaut. Up to now," he said, "the Americans have succeeded only in bringing back animals after a few days' flight on a ballistic trajectory, but Soviet cosmonauts have now been credited for the second time in landing living creatures in a predetermined area from a Sputnik, ending our globe."

Lukash concluded that Russian experiments have demonstrated the true technical proof of design and capabilities for manned space flight.



Supersonic Ejection Capsule Tested

Flight of a manned zero escape capsule from a Convair-440, North American Aerospace, launched at speeds of over 550 mph will be carried out over Edwards AFB, Calif., this summer. Tests will comprise the hottest controlled ejection of man ever made from an airplane. Initial ground testing has been carried out including ejection of a capsule from a Convair-440 at Convair F-100 (North American), developed and built by Douglas Aircraft Corp., Denver, for Convair, is fired from the rear stream via a rocket catapult, then its own rocket motor takes over.

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Electromechanical systems by **Autonetics**  Division of North American Aviation

Venus Probe Carries Long-Range Antenna

Sevent Wynn probe, which has not transmitted signals since Feb. 7, was never broadcasting to mid-May when a large, parabolic return is scheduled to unfold from the parabolic structure for interplanetary, cross communications.

Possibly, that the probe is intended in part rather than through a well-known but isolated in a relatively detailed Moscow News account of the probe, and its instrumentation. This report says the probe contains several used for orbit and earth phase communications and a red antenna for medium-range transmissions. The long range antenna is a 5-6 ft. the probe is loaded with a pencil beam, which is useful as the probe approaches Venus. Close approach to the planet will cause the probe to be destroyed.

Communications with the public, aimed at a range of 4 million no-nuclear areas of the public Soviet scientific reports have hinted that this was planned. Speculation in the U.S. was that the solar transmission system went out, or that the generation system failed and the center was flooding.

It is possible that Russia is waiting to determine whether the telephone tap communications nation will have time before making any announcements. It could produce a propaganda campaign to would expose the U.S. own communications range record of 21.5 and have no established by Point V. Soviet probe will be 43.5 million m from the earth at its closest approach to Moscow.

The 1,415-lb probe, called an autonomous infillation station, consists of a pressure vessel 6.52 ft long and 3 ft in diameter. Solar panels rotate with different coatings to measure flow differences and an earth-sinking sensor is attached to the outflow of

- **Concentrations**, in which the son walks

- **Orientation**, in which the molecules are aligned on the site for stabilization. It occurs in the neighborhood of Voids that the paraboloid axial stress points toward the clefts. Stress also causes random tumbling and free rotation when the probe was hatched from site
- **Instrumentation**, for measuring carrier rate, magnetic field, orientational charged particles and solute reactivity, solvation, and macroscopic impact
- **Radio**, general in chemical kinetics, macroscopically changed to solar cell

the authors suggest in addition to increase public involvement in relation to the work, to transmit scientific well-founded and rational environmental and to secure economic. The Science Centre has both economic conditions

and self-contained positive capabilities.

Sarkis continues to maintain an official society about his branch rebuffed and ground campaign. The Moscow News, however, identified as a control point the Center for Long Distance Comm. Radio Communications, which is the filter center for tracking air reports. Tracking stations have been equipped with narrow band, low noise, receivers and with large antennas for the Vozna project.

The Cosmic Radio Communications Center computes the projected trajectory and program pointing directions for cosmic stations. Antennas can be "aimed" to any point of the celestial sphere with an accuracy of several minutes of arc," according to Mission News. Solar orbital elements are now 91.8-million-km aphelion and 65.9-million-km perihelion. Late is Hebrew. They give these signs at 94.7 and 66.7 million km.

AAS Rejects Merger With Rocket Society

Washington—American Astronomical Society has again in print its *American Rocket Society* proposal that the two organizations merge, and the AAS Board has decided to halt further efforts toward a merger.

ARS proposal, second since 1999 was made to reduce what it considers the number of expenditures with overlapping interests, which would reduce the growing number of technical meetings—a new point in government and industry because of the tax, and expense they demand.

NAS feels that although each technical society has its strong areas of special interest, there is a vacuum in the organization of the multitudes of technical and scientific disciplines, and the Astronautical Society is moving toward an interdisciplinary membership.

ANS meets to keep its membership small but representative of the growing number of specialists in physical and life sciences. President Alfred M. Mason told William Wark:

The most of the growing number of technical writings were done by a team as a result of two independent discussions: one held last week and another scheduled next month. American Society of Mechanical Engineers, both one of the "Sponsoring Societies" ASME and Society of Automotive Engineers met last week at the request of Harris Corporation of the Corporation to know better to explore ways of reducing the number of technical meetings.

Aerospace Industries Assn. guided meeting concerned has asked AAS, ABS, TAS and ASME to meet Apr. 20-21 at Hanscom Field, Mass., to discuss the same subject.

News Digest

Thomas P. Alexander, Jr., former mayor of Baltimore and Democratic Congressman from Maryland, was nominated last week to be a member of the Reconstruction Board.

Study contracts to establish design requirements for 3-Duration B thruster launch vehicles based on F1 and F2 booster engines was awarded last week to Conquest North America, Arlington and Martin Marietta National Aeronautics and Space Administration.

Northwest Airlines has filed a \$2.7-billion suit against Lockheed Aircraft Corp. and General Motors Corp. for the loss of an Electra turboprop transport near Teller, Ala., last year.

General Electric Defense Department has a \$170-million Navy contract to redesign work on the advanced Mk 64 Polaris submarine fire control system.

Two new suits have been filed against Chassis Vought Corp., by Long-Term Investments Inc., both of Dallas, Tex. One suits acquisition of Vought's stockholder list in preparation for Long-Term's suing a stockholder proxy fight, which it said it plans to conduct on Vought's May 25 stockholder meeting for other antitakeover Vought's right to name stock. litigants in suits against stockholders are creating relief

USAF-Congress Adm E limited about 2,000 m short of its planned 4 000 m range, when the submarine engine shut down prematurely in a test last week at the Atlantic Missile Range.

Harold B. Finger has been appointed assistant director for nuclear applications in the National Aeronautics and Space Administration Launch Vehicle programs office. Previously nuclear program chief under the propulsion assistant director, Finger is now manager of the joint NASA-AEC Space Nuclear Propulsion Office.

California Eastern Airlines plans to change its corporate name to the Domestic Corp. to reflect its diversification in products and services. The change must be approved at the company's annual stockholders' meeting, scheduled June 24.

Thiokol Chemical Corp., reported to be discussing merger possibilities with Baltimore Paint & Chemical Corp., said that Baltimore Paint & Chemical was one of a number of companies it has considered for acquisition but that Thiokol has made no proposal to RPM-C.



SAS Seeks to Double Its Working Capital

Airline is asking three Scandinavian governments for funds to overcome financial hazards it faces.

By Cecil Bretherton

Stockholm—Scandinavian Airlines, which has expanded fourfold over the past 10 years without once increasing its bank capitalization, is striving to overcome a series of crippling financial hazards—some of them man-made, others more chronic.

Buffered by the loss of approximately \$16.8 million during its last fiscal year (AW Feb. 13, p. 47) and facing prospects that are almost as bleak, the current 12-month period, SAS, in an immediate step is asking the governments of the three Scandinavian countries directly concerned to provide funds that would approximately double the airline's present working capital of \$31 million to about \$60 million.

The three governments—Denmark, Norway and Sweden—own 100% of the airline's stock. The remainder is divided among private capital and SAS itself in periods of the first time the airline has not received a subsidy payment since the time of its post World War II inception.

However, such from as state resources, the expenditures, associated with becoming a member of the jet age, including market value of jet engine equipment still on hand, the new requirements of the airport authorities—i.e., the need of maintaining a higher density of operations at each of the three airports, of splitting maintenance work and schedules in an effort to ut-

ilize all three—make additional capital mandatory.

"And, in one official opinion, 'we would be hard put to find sufficient money from private sources. So we have to turn to the governments."

The respective members of the three nations are presently studying means of meeting the impact and there is little doubt that aid will be forthcoming in one form or another. The final split might follow the lines of government involvement in the corporation. Sweden holds 33% of the shares, Denmark and Norway two-thirds each.

Some of the airline's financial diffi-

culties are not so much result of modernization and expansion—where time lagged the airline almost from its inception.

• **Expenditures** of an estimated \$147 million for the jet equipment needed for the airline's various route structures and the facilities to handle them plus fuel delivery costs.

So, SAS had hoped to limit the first of its new Douglas DC-8s in service at the beginning of the new airline summer travel season which opens Apr. 1.

Because of delivery slippages, the airline would its target to almost two months and, faced to face jet competition with piston equipment during the period first out on considerable financial losses.

Slippage in delivery dates of the Canadian 990 medium-range transport from an original March 1961, to the present October schedule has had a very real effect and means that SAS must stress not only on the airlines jet service on some of its Far Eastern, South American and African routes.

"I don't know what we can do about it," one official complains, "and when the jet comes around we will still be lost to go it."

• **Cost of maintaining** the leadership using various of its DC-8s fleet to reduce shop, increase take-off and fuel expenditures (AW Nov. 7, p. 39) and converting those capacities to 17,000 lb thrust Pratt & Whitney JT4A's from the 9 is the more powerful JT1 remains in order to increase available take-off thrust.

SAS engineering officials estimate that the new modification has each engine will cost approximately \$500,000—\$100,000 to Douglas Aircraft Co. for the jet plus another \$400,000 for the necessary tooling, labor, etc.—to do the work at Copenhagen's Kastrup Airport. (The conversion cost is estimated at \$100,000 per engine, at about \$600,000 an aircraft. Overall cost of the DC-8 modification program to SAS is about \$149 million at present figures versus five.

The airline has pressed Douglas to phase the modifications into use; it says the aircraft failed to meet the specific fuel consumption figures required by the company but adds that, then in, the U.S. firm has declined to do so.

• **Investment** in two foreign companies—Gust Avionics de Mexico S. A., and Turbomeca International—in a recent



United Caravelle VIR Cockpit Modifications Detailed

United Air Lines Caravelle VIR cockpit undergoing light work in preparation for initial delivery in April or May (AW Feb. 20, p. 37), displays "hidden" cockpit modifications to upper portion of cockpit to permit more room in the light seat. Cockpits display cockpit window and the deletion of an engine gauge for better clearance to the original design cockpit.

of expanding the airline's air-air route structure and of boosting its international scope. Neither came paid a return on investment last year, but SAS officials say that America's fast outbuilding still is a strong regional carrier in the Far East and feel that it may begin to yield a return within the next few years.

Their outlook for Great America is not so optimistic although they see a possible potential for the carrier if it can find the funds to finance a DC-8 purchase and compete on an equal footing with its competitors in its major international ports—namely the mid-Atlantic, between Mexico City, Miami and Madrid. Current piston equipment used on the line is losing money steadily.

• **Annual sharp decline** in winter load factors will reduce industry receipts. For the last quarter of 1960, as an example, SAS passenger load factors for the Nordic Atlantic was 87.5% as compared with 55.5% for the entire airline as a whole. Scandanavian North Atlantic load factors, on the other hand, are comparable with the overall figures for the industry—66.5% for SAS, 69.1% for the industry in 1960. Effort to close this gap, which threatens to grow larger in the capacity of the first Atlantic summer season, is a major factor behind several of SAS's current air campaigns.

• **Upgrade of headquarters** and service facilities in Copenhagen, Oslo and Stockholm to fit the new station structure of the airline and the resultant high costs. DC-8s, aircraft, in re-

structure, are maintained in Copenhagen, which, they expect, are available in Stockholm.

So far as the latter problem is concerned, there is an apparent process. Each of the three nations quite naturally wants its share of the workload and the prestige accruing from the speediness of, and participation in, a modern international airline.

SAS has been using Copenhagen's new airport as the DC-8 terminal for all flights and had hoped to continue to do so at least another year. As an official notes:

"When we put the DC-8s into service, we found that the best way to fly was those would be to have all flights originate in Copenhagen, leaving out the Stockholm and Oslo flights by Caravelle."

Sweden, however, is constructing a modern \$30 million airport at Alnäs in the midst of a forest of tall pines. Although construction is still under way, it may be for the first time around here, the \$1,000-ft. runway is complete and there are facilities enough to handle the passenger—the present reception building will accept its intended role as a group where all the airport buildings are completed. And Sweden is anxious to become an international transatlantic DC-8 terminal port of the continent's traffic.

So, when the summer schedules go into effect on Apr. 1, two of the placed 22 monthly DC-8s flights from Stockholm to New York will originate in Stockholm.

Alnäs also is scheduled to take over all international traffic originating or terminating at Stockholm by Apr. 1, 1962. Leaving the market, once completed, Roskilde Airport means the city in the center for domestic traffic.

More to Alnäs, necessary to find the land for the larger runway needed today and to avoid jet noise complaints from the homes and industries surrounding Roskilde, is another example of the jet age cost to SAS.

Although the Swedish government is financing the construction of the airport itself, SAS is financing approximately \$7 million there as a line construction; larger that, when completed, will be capable of handling eight DC-8s simultaneously.

It is also clear that the airline will be forced to build a new Stockholm regional building in the suburbs to place the present site in the center of the city in order to handle the passengers that will be a mixture of different. Under present planning, outgoing passengers will report to the terminal which will be a five-10 minute ride from the heart of the city and then be transported to Alnäs by express bus.

A four-hour express from Stockholm to Alnäs, just off the main route to the main-line lines of Uppsala, is under construction and, when completed, SAS officials hope the present 35 min. driving time to the airport from Stockholm can be shaved by a considerable margin.

SAS also has had to bear the cost of a \$1-million engine overhaul facility,

Convair 990 European Deliveries Delayed

Copenhagen—Recent delivery date of the Convair 990 medium-range jet transport to two European airlines—Scandinavian Airlines System and Swissair—has been delayed by at least another two months.

Present target date of October for jet deliveries means that both airlines will miss out on the profitable summer season and late potential revenues estimated to come to be well above a million dollars.

Swissair had intended, before, upon receiving the airline in time to begin a new set of air schedules in the fall. It has been having jet competition in the market for the jet was while other major Douglas DC-8 jet engine airlines to serve its own routes and has been anxious to make the switch at the earliest possible date.

SAS also expects much the same to airports elsewhere on a number of its Far Eastern, South American and African routes.

Swissair and SAS officials have been meeting with Convair in San Diego since the summer for the delay and over the possibility of losing other major Convair 580s to Italy early through the summer period. Some officials of both airlines have observed a lot of confusion of the order.

One apparent reason for the new delay is discovery of serious vibrations in the engine nacelles. Engine mounts required to be shortened by 35 in. each in an effort to correct the problem.

Digital delivery date quoted in Swissair for the first of seven 990s in order was March, 1961. This was postponed to May several months ago following delivery in the first flight of the prototype. Word on the recent delay was several other jet firms. Two of Swissair's 990s is to be leased to SAS which has called machine less directly from Convair.

Latenture, near Bismarck in handle the DC-8/ JT4s and the Rail-Rover Aeronautics on the airline 113 project. Gulf Coast's medium range jet transports, Embraeres, which last year, in its latest year, and finally began the rolling second DC-1. Also handles some of the major domestic maintenance and overhaul for the airline.

Equipped with two engine jet cells and the most up-to-date overhaul tooling available, Latenture is in the market for more work after an loss since the Aeronautics JT4.

At present, the shop is overhauling between one and 10 JT4s per month and plans to add up to 100 per month in the near future. Latenture began working on the JT4 from the moment it opened its doors but is just beginning to overhaul the Aeronautics JT4s. Aeronautics has been handled by Rail-Rover in England.

When Latenture began operations, all available technical input was needed to work on the jet transports and the Rail-Rover, which has been handling overhauls for SWS proto-engine East for the jet as months in a temporary lease. Whether the work will remain at Salem or be brought back and handled in Latenture is still being discussed.

"We've told them that we'll leave at their request (see Bismarck) if they will give us some of their 'own equipment,'" according to Gulf Haggar SWS vice president for operations, maintenance and overhaul. Otherwise, we'll have to pull them back to Latenture."

In discussing the need to support maintenance, Bismarck in three different locations, Haggar says, the jet has created no problems.

In the old days, he explains, it was extremely simple. When a jet, one of the DC-8s, Sweden Jet, the DC-8s and Douglas DC-8s. Then we started selling the DC-8s and bought DC-8s. It was cheaper, of course, to send DC-8s to Bismarck since the older jets were easier to handle.

Next, a large, heavy maintenance unit came last week under a Civil Aeronautics Board decision which is a huge industry that the Board will continue to emphasize, including airline cooperation in strengthening the maintenance of the smaller traffic lines.

The Board's decision in the Southern Transcontinental Service Case creates two new routes linking Florida and the Southwest are directly with California. Northern's routes are extended from Houston, Texas, to San Francisco via Las Vegas and to Los Angeles via San Diego. Delta's route routes are extended to the same points from its present eastern terminal point of Dallas/Ft. Worth.

Haggar and other SWS officials also hope that some of the modification work on the DC-8s can be incorporated

once the aircraft have been put back into operation. Launching of the day by thinning the leading edge of the wing. Haggar estimates, will use approximately two tons of fuel as a main (interim) measure. "As, taking in the fuel tanks, and if we can sell the additional payload, we can pay for the modification within a few years."

Modification of the seven DC-8s will be divided over two winters beginning this fall, to avoid any possibility of having an aircraft out of service during the peak summer season. Modification of each aircraft will require approximately three weeks.

SWS plans to use the leading-edge modification for the three DC-8s it operated by Southwest, its joint venture partner. The Southern carrier, however, abandoned earlier plans to outfit additional wing tanks during the past winter as an interim measure while Southwest finding itself unable to compete on a weekly transatlantic schedule because of the increased fuel consumption, made the modifications on its DC-8s.

SWS officials say they have been able to make the flight to New York, not only because they fly a more northern route than Southwest where the winds are more challenging and, therefore, depend upon installation of the wing tanks.

A Southwest official says the wing tank tests, as expected, have not completely solved the wing problem. The wing, however, will be modified as planned for next winter."

If Gulf Aeronautics should purchase a DC-8, as overhaul in all production, also will be conducted by SWS. If it does not, even if it should not

issue to fly by the end-of-the-year with SWS service, its future relationship with SWS seems problematic.

The Southern carrier, in response to a request for help in establishing a route to the Atlantic coast, the proposed lanes, helped it with equipment and acted as the airline's general sales agent outside Mexico.

"We have," an SWS official says, "just it was our base for them to compete on the mid-Atlantic route, although their last service has been good. It's not once to the point where they must get it replaced."

If they do not solve their problem (wing tanks) to finance their equipment, it was his belief that the airline, the situation should change."

In its service with Texas Aeronautics, SWS has purchased a "new aircraft," said building and provided technical maintenance, crew and aircraft. This has purchased several DC-8s from the European market. The Southern carrier and administration are being forced to bid in the market of the airline, and SWS officials say the airline's best looks good.

In the Eastern market, which includes routes from Bangkok to Calcutta, Singapore, Saigon, Hong Kong, Taipei and Tokyo.

When this gets on its feet, it will relieve a financial and technical drain on SWS and, eventually, bring pumping money back into the operation in the form of payments on loans and in interest on stock purchases.

(This is the first in a two-part story dealing with SWS. The conclusion will follow in the May 27 issue of Aviation Week.)

Transcontinental Routes Awarded To Strengthen Delta and National

By Robert H. Cook

All existing intercity agreements over the southern transcontinental routes have been announced by the Civil Aeronautics Board, which will award single-carrier service connecting Florida and the northeast with the West Coast. Interagency agreements previously in effect included Continental Airlines, Delta-Airline, National-Delta Airlines and Braniff-TWA-World Air Lines.

Their routes were awarded to other airlines as follows:

- American Airlines gained a new route segment connecting Ft. Pao, San Antonio, Houston, Texas.
- Eastern Air Lines will establish a new route segment between Ft. Worth/Dallas and Tampa, on the intermediate point of New Orleans.
- Continental Air Lines was given a new route segment between Houston

and Los Angeles via San Antonio, El Paso, Texas and Phoenix.

Noting that it generally agreed with the recommendations of Executive Edward T. Stohls (AW June 27, 1968, p. 18), the Board emphasized the need for two airlines along the southern transcontinental route but also noted the problem of providing regular service south from the desert quadrant service.

The selection of National to operate one of the two new transcontinental routes, CAB said, was made because of the carrier's need for more strength along, coupled with the fact that award of the route may be the last opportunity to expand the airline's system to a point where it can sustain large range jet operations.

Delta's route was granted on similar grounds, with the CAB adding that the selection of other American or Eastern for the new route would have departed Delta of a considerable loss of service from its southern transcontinental intercity service and would also weaken its competitive strength.

In order to establish separate south-to-west transcontinental routes, the Board instructed Delta to discontinue its single-carrier service between its point in Florida south of Orlando and any point west of Ft. Worth. In this case, Delta and National will divide the route, with National flying South and the West, the Board said, with Delta responsible for servicing the West Coast service from the Northern Florida and Alabama/Georgia area and National providing service in southern Florida.

Service to intermediate points between Houston and the West Coast, including such stops as San Antonio, El Paso, Tucson and Phoenix, were properly required, regional, rather than a transcontinental type of service, the Board said. Authorization for both American and Continental on a Houston-to-the-West route should still provide National with an additional \$10 million in service revenue over the transcontinental route while Continental should realize an estimated \$7.5 million serving Houston and the intermediate points, the Board said.

In contrast, CAB said Delta has long been provided with unrestricted service by American by most of its en route markets to the West and does not require competitive service to Oklahoma, Arizona or Florida. The Delta-Phoenix route is not large, the Board pointed out, and provided only about 5,000 passengers in 1967. The Board did, however, comply with a request by Dallas for single-plane service to Las Vegas, providing that the two airlines will be in service on different aircraft and meetings to work the city. The authorization of Delta

to provide this service also contains a provision against rescheduling Delta flights to San Antonio.

The same restriction was placed on National on its Houston service, the Board said, to prevent any dilation of local traffic between Las Vegas and San Francisco. In a similar manner, CAB said it would limit Delta's route from Albuquerque that American, Delta and National be granted an additional route segment connecting Los Angeles with San Francisco.

Reversing its position for serving Eastern into Dallas for a Dallas-New Orleans-Miami route, CAB ruled at session in Eastern's declining financial strength and the increased competition from the fact that four major airlines, including Capital Airlines. Although recommended by the Research for the route because of its need for long-range, high-density traffic markets, CAB would offer less specific details of its service route than the Eastern, and should not be chosen for the Florida route, the Board said.

CAB expressed concern over Eastern's flight schedule, "we are concerned that the competition between carriers operated by the (Federal Aviation) Act would be preserved if the economic position of any of the trunk, whether classified as a big firm or a non carrier, big firm, it is permitted to determine in relation to other trunk line carriers with which it is required to compete. Maintaining the strength of Eastern is of substantial importance in our estimate goal of providing an balance in the service of the carrier that are required to compete with each other."

In this case, CAB also devised a special type of service, pointing out that more than 200,000 letters and coaching passengers were carried in 1967. The route, which began operation for the past year, has been almost by Northwest's strike problems. At the end of the year, the airline was awarded a Northwest 720B as a means of competition on the Boeing line.

Delivery of the nonstrike aircraft is scheduled to begin in June, with first service in July. Northwest plans to use the aircraft to serve the route between Los Angeles and San Francisco. The airline, however, has single range for service transcontinental service and West Coast flows service, Northwest and Continental will be in service on different aircraft and meetings to work the city. The authorization of Delta

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Class Rates Are Final For 12 Local Airlines

Washington—Twelve of the 11 local airline carriers began operating this month under class rates after retroactive to January 1, 1968. The Civil Aeronautics Board, in its final ruling, to accept the new Civil Aeronautics Board rates.

Central will present CAB with agreements against accepting class rates later this month. Originally, three local airlines, including the Central, had been asked to accept the new rates, but all but Central subsequently decided to accept them.

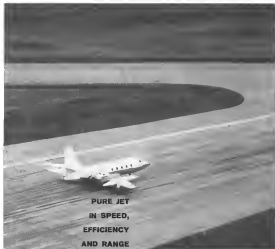
Under the old rates of individual carriers, a carrier included its revenues, which were determined by the Board, much more likely to break even and provide a reasonable return on investment than applied for the rates. CAB feels that system encouraged a carrier to keep its operating costs high and its fares low, and to maintain schedules not justified by high loads.

Under the class rates, operating costs have no direct bearing on the amount paid in rebates, which is just in the form of a rebate. The carrier is required to provide as much as possible, but CAB feels that system encouraged a carrier to keep its operating costs high and its fares low, and to maintain schedules not justified by high loads.

Operating costs affect indirectly only in that they are related to all local carriers for the preceding local year, with certain adjustments, and used as a base to determine the class rate for the following calendar year.

The class rate takes the form of a sliding scale. A given carrier's fares in the daily schedule or on a seasonal basis will be a certain percentage of the applicable rate which is multiplied by the applicable rate. The scale varies from a minimum of 3.11 cents for 100 average daily miles per day to 3.94 cents for 602 miles per day. The scale varies with passenger volume, the applicable rate rate decreases.

The second part of the formula is a profit-sharing plan whereby the airlines will rebate to CAB 50% of any savings in operating costs. The scale varies with passenger volume, the applicable rate rate decreases. Profits in excess of 15% will be a 75% rebate.



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PanAm Divestiture Portends Wide Effects

By Glen Garrison

New York—Possible far-reaching effects of a May 5 court decision that Pan American World Airways should divest itself of Panagra stock include a future dispute over the Civil Aeronautics Board as to whether U. S. Grace & Co. should control Panagra.

If the decision stands, it also will probably mean a reshaping of the U. S. flag competitive picture between this country and South America, particularly the west coast of South America. A Panagra line to port for routes into the U. S. could effectively add a third independent U. S. competitor to the market.

The closed removal of Panagra to Pan American has prevented Panagra's development of such routes, the court found, and on this basis the decision is upheld.

Grace, operator of a shipyard line that presently serves Panagra's routes in South America, owns 10% of the airline's stock, with Pan American holding the other 90%. The three companies are defendants in the lengthy antitrust suit instituted by the U. S. Justice Dept. in 1954.

Late last week Pan American was scheduled to appear before U. S. District Court Judge Thomas I. Murphy here to seek more time in which to show cause why a final decision in this case should not permit the stock divestiture. Judge Murphy has handed down no opinion which

• Decried government charges that Pan American and Grace, despite over 20 years of seaborne and transoceanic trade between the U. S. and South America by forwarding Panagra under joint ownership since 1929, and by agreeing to a division of territory between the two airlines under the agreement. Pan American now to develop traffic on the east coast of South America and Panagra on the West Coast.

• Found that Grace's ownership in Panagra does not violate antitrust laws and that Grace and Panagra have not been guilty of an antitrust violation.

• Called Pan American's antitrust suit against Panagra and "continued discrimination to suppress the extension of that airline to the United States" an antitrust violation that would seem to require divestiture by Pan American.

• Declined to the primary jurisdiction of CAB the question of Grace's control in the management of Panagra and the legality of joint operating sales offices and the IIA between the two airlines.

While Pan American has an official comment on the decision, most observers feel the suit will appeal. The

Justice Department has a high likelihood of appealing the ruling that Pan American and Grace were not violating antitrust laws in their Panagra combination and the division of territory.

But it seemed unlikely that the case would drag on for additional years. Reason need stop an appeal in the Supreme Court of the United States, under a special expediting statute covering civil antitrust cases involving the government. Estimates by legal observers are that all or part of the probable time for hearing in the Supreme Court awaiting the appeal or appeals take place and the high court agree to hear them.

Next mandatory step in the three case procedure is Pan American and, assuming Judge Murphy's opinion is unchanged, a decree will then be entered ordering Pan American to divest its Miami operations and its Miami, New York and the West Coast of the U. S. CAB action has been suspended pending outcome of the antitrust suit.

With Bozell International Airways operating between Miami and the Canal Zone, and now South America, a Panagra route to Miami would mean a three-cornered strategy between Balboa and the U. S. This has raised the question of a possible merger between Panagra and Bozell.

For a spokesman for Grace said last week, "we have no intention of merging Panagra with Bozell."

In the court's opinion, Pan American's ownership of Panagra's stock, as the U. S. court finds, is an antitrust violation. The power Pan American had to exclude Panagra is a conspiracy in the United States-South American market and thereby maintain its control over the airline market. But it is not at issue and the suit of Bozell is 1948. Therefore and to date, Pan American remains the dominant force in that market and maintains its power to persuade, or, substantially, all United States major or disruptive traffic carried by Panagra through its continued ownership of a Panagra United States extension.

Pan American's position, according to Judge Murphy, is founded on a false position. Panagra is not part of the Pan American system except to the extent that it is related to that system through the subsequent extension of Pan American's shipping control over the U. S. Panagra route which would be lost pending link with United States.

A vital question for a Panagra free from Pan American ownership, control would be the matter of routes into the U. S. Since 1935, according to the court, the Grace had of Panagra's board of directors has sought to file applications with CAB for such an extension. Panagra's present route stop at Balboa Canal Zone and various difficulties is provided in understanding arrangements. Panagra route opens. Panagra route from Balboa to Miami but the flight is Pan American's responsibility. From Miami to New York, Panagra equipment is operated by National Airlines, cross on National interconnecting flights.

But the court said Pan American board members of Panagra have been instructed that it would not be in the interest of Pan American stockholders for Panagra's director to authorize an application by Panagra to extend control of the Canal Zone in competition with Pan American.

However in 1957, Grace, on behalf of Panagra, had application for routes to Miami, New York and the West Coast of the U. S. CAB action has been suspended pending outcome of the antitrust suit.

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PANAGRA routes could be extended to United States if divestiture of Pan American held ownership is placed. Panagra has applied extension. Panagra route from Balboa to Miami but the flight is Pan American's responsibility.

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data that its extension to a Great Britain terminal would have been at several decades ago."

The government's case against Pan Am, which involved charges of unfair competition, charges of stock in competing airlines and subsequent restraint, price fixing, and impeding the development of Brazil's competitive airline "to maintain in the distant past its market and deny it a highly competitive field," the court found. Of the charges of impeding Brazil, the court and government evidence "seem to picture Brazil, an experienced carrier, in an innocent way as the air transportation business, being belittled and looked at by Foreign. The government showed that even though Pan Am was helpful and courteous to Brazil in its initial years flights [Pan Am] became piggybacked and undesirable when it involved upon being paid for the use of its facilities and supplies and services. We get the impression that Brazil wanted everything for nothing, including rights not recognized."

The court added that Brazil gets a fair share of South America traffic to dig into at much losses in Pan Am, after being in the market only 10 years as against Pan Am's 38 years in the market. Another Justice thought there was that there is competition between Pan Am and Grace for passengers and cargo traffic. Judge Murphy found no evidence that the air and sea passenger markets are interchangeable. No travel, he noted, is quick, efficient and functional transportation for passengers over long distances. Steamship companies, on the other hand, "enter in those who have for years and industries for a sea voyage."

The issue remaining applies to cargo markets, the court found, in that the markets are different. Regarding testimony that the air cargo field is expanding and that in the future growth is in interchangeable service, Judge Murphy held that the volume of cargo carried by Pan Am compared with Grace was "insignificant." All cargo air transportation is an experimental stage, the court said, and most of the operations are marginal at best.

Even if Grace had been shown to compete with Pan Am, the court found, this would not create a violation of anti-trust law. Grace has not organized or monopolized trade in this connection. If anything, Grace was the only one of Pan Am's two partners that has positively attempted to improve its service and extend its routes in the U.S.

Regarding the charges of conspiracy against Grace and Pan American, Judge Murphy said the only agreement between the two companies that approached conspiracy was their understanding that the air services would not preclude each other's routes. This,

the court held, was not a conspiracy to monopolize and restrain trade.

Joining of Grace and Pan American to use their complementary facilities was a natural and necessary consequence, the court found, and an economically sound arrangement for the establishment and development of American commercial aviation in the West Indies. Since the two airlines had branches, agencies and other facilities that could be used in its new airline operations Pan American had the technical aviation skill which Grace then lacked.

B. 152 Is Completing Flight Test Program

Keeping Second prototype of the Biele B.152 supersonic fighter transport a completing its flight test program at Vels Flugversuche in Germany, according to East German officials at the Leipzig Technical Fair. Roland Schumann, director of Technische Gesellschaft, of Berlin, the East German state organization responsible to the government for all aircraft sales and related products, and "production of the jet transport is expected to go ahead as rapidly as possible."

First prototype B.152 crashed in the spring of 1959. At last year's Leipzig exhibition, Heinrich Kist, minister of foreign and intra-German trade of East Germany, announced that the second prototype was expected to be ready for export around the middle of 1961 (AVR Mar 24, 1960, p. 67).

However, in the opinion of a number of observers here, it is probable and whether the original production program can be kept. Even the East German airline, Deutsche Luftfahrt, which hopes to introduce its first jet aircraft with the Biele B.152, does not expect delivery of the first production models until 1967, or possibly early 1968. Actual cases of the apparent delay was not disclosed.

The aircraft display at the fair this year was comparatively small and one local promoter in exhibits displayed previously. Technoexport officials said that foreign participants particularly those from France and West Germany, had asked for more space this year than in the past and that, so far as possible, such applications were granted at the expense of the East German hosts. Technoexport cited this fact as the reason why Vels Flugversuche was asked to display even a section of the B.152.

At its last year Vels Technoexport of Berlin, which is responsible for design and development of hardware in East Germany, featured a model of the Biele B.152. The firm also exhibited a model of the

Pass 118 kg. 107 hp. turbo-prop designed as an auxiliary powerplant for various industrial applications and which was to be used later on small aircraft (AVR Apr 10, 1960, p. 10).

Onagard, Ltd., of Prague, the Czech foreign trade organization, displayed the only two aircraft seen at Leipzig this year—an improved export model of the Onagard 118, and a two-seater, first test ability transport and the Z. 534 Taurus Master, a two-seat tandem, low-wing plane.

According to Onagard, a new unit belonging to the Z. 534 designed specifically for ground service, using a piston engine, is under development. However, details of the new model, which reportedly is a modified version of the Czech multi-engine HC-102 Helix helicopter, were not available.

Task Forces Prepare For Aviation Studies

Washington—Two Kansas Aviation studies, aviation task forces were beginning to prepare last week to map national aviation goals and analyze the air traffic control situation.

Extensive research, several joint studies on aviation, such as the Gates and Harding reports, will be the initial objective of the committee on national goals headed by Paul M. Giles, an executive vice president of the Empire State Building and a former member of the Harding Committee and of the Reed Committee which conducted a study of MATS.

Primary purpose of the task force is to determine the functions and responsibilities of both military and civilian aviation in a basis for reflecting the maximum potential use of the nation's total aviation industry for the coming decade. Labeled "Project Planning" by the FAA, this committee expects to make its first recommendations before the next four months.

Members of the committee have not been chosen yet, but Giles has indicated he expects to select the members this week.

The White House-appointed committee on air safety is being headed by Richard B. Hoag of Cleveland, Ohio and will also submit a report in its findings to FAA Administrator Noyah E. Hildreth within the next few months. Its task will be to analyze the present system of air traffic control, the needs of the army and the status of all present air-transport programs and then set a goal for the future.

To guide the committee in its study, Hildreth and Dr. Jerome B. Warner, associate advisor to the President, are also forming a scientific advisory group under Dr. Frank D. Paton, chief of the physics at the Massachusetts Institute of Technology.



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SAS Caravelle Modifications Proposed

Copenhagen-Denish Directorate of Civil Aviation has recommended a number of basic operational and structural alterations including modification of the down-type altimeter for the SAs Caravelle in portable and jet transports in general, following an investigation of a Scandinavian Airlines System Caravelle crash during a low approach to Aarhus's Egebjerg Airport.

The report, made after an investigation in cooperation with the Turkish Directorate of Civil Aviation, said the official cause of the accident on Jan. 16, 1969, that took its toll of all 37 persons aboard, could not be determined "due to lack of conclusive evidence."

In the bulk of the text, however, the investigation said "under the prevailing circumstances of high workload a reading error of 1,000 ft" on the down-type altimeter "may have been made by the crew but not noticed. Such error is known to have been committed during flight training in the simulator as well as in the air."

Only one of three altimeters aboard the aircraft was a down-type but the captain, who had control of the plane at the time of the crash, was relying primarily upon the latter unit. "Since the face of this instrument is new," the report said, "the possibility of a misreading of 1,000 ft cannot be precluded since the visual experience in reading it must be said to have been limited at the time of the accident."

The investigation also noted that the Caravelle encountered steep climb, turn and low rollings on the approach which the crew may not have expected upon no mention was made of such conditions in the forecast and they did not prevail upon the airport staff. This concluded.

"The reported as well as the actual weather at Aarhus was above normal. The fact that the actual weather of the crash area was more than reported often be considered a basic reason for descending below the minimum flight altitude but that have taken the risk by report, since the actual weather at Aarhus seemed just before commencing the approach was much better."

"When the aircraft actually came in too low, the combination of low visibility and the absence of significant landmarks and lights from reflectors could seriously have affected the possibility for a corrective maneuver."

The smooth air traffic approach made OY 88R, crashed at a point approx 600 ft above the threshold of the runway and about 1,000 ft to

the right of the extended centerline impact point was 3,100 ft above sea level. There had been no indication of turbulence for the cockpit, the cockpit floor was not over 100 ft from the tower.

At the time of report, speed brakes, landing gear and flaps were extended and the engines were under power. The aircraft struck the ground in a steep climb, attitude in a 5 deg nose-up position at an approximate impact of 60 kt, continued along the ground for another 200 ft and disintegrated.

The report said that, after beginning a climb from 12,000 ft, "from the start of this descent until the air crash crashed was with great probability between 35 and 45 min. The altitude loss of 5,500 ft gives the rates of descent averaging approximately 2,000 ft, 1,700 ft per min, which means that, if the time needed for start and backoff of the altimeter must at times have decreased, 1,000 ft to 3,000 ft per min."

"Total loss of flight training in the simulator with 3.5 sec, it is possible to perform such a descent without exceeding limit speeds for various configurations (landing gear down, etc.), but that descent with a down altimeter would produce a speed close to the limit of 300 kt."

Directorate Recommendations

Recommendations made by the Danish agency after its investigation are to be put at the discretion of the civil aviation authorities and SAS towards improving its safety," the report said.

These are:

- Below a certain altitude a maximum rate of descent should be established. The report proposed a maximum of 2,000 ft per min, maximum flight altitude, plus 1,000 ft.
- Case of the jet altimeter should receive special training in high altitude approaches.
- Standardized high-altitude approaches should be established at all airports with jet operations and relevant approach charts revised.
- Instrument landing approach systems should be introduced as soon as possible at all airports into which jets are operated as the time of the accident. In the U.S. was in use "no need" but the glide path transmitter was not operating, and the report notes that an ILS approach may have been made "if the crew, knowing or realizing the absence of the glide path signal."
- Crews should receive special training in reading "no-fly instruments."
- Instrument landing charts should be supplemented with information regard-

ing airport equipment not in actual operation.

- "Best possible reading conditions should be established for the cockpit crew by keeping all but passing flying data away from the captain and co-pilot and by introducing modifications in the cockpit in order to facilitate crew work."

- Routine checkmating of primary flight instruments should be stressed.
- Down-type altimeter should be modified in order to reduce the possibilities of misreading it.

- Measures should be taken to eliminate the possibility of misreading information from the flight director system.

- "AT" aerodynamic in Caravelle aircraft should be stopped and slowed.

- Modifications eliminating the possibility of jamming the control columns should be introduced. The report had noted earlier that "certain loose equipment may probably interfere with the free movement of the control columns, mainly due to the fact that the distance between the columns and the cockpit walls varies with the position of the columns. The most likely loose equipment in question are the hand microphone, the turn light, the radio manual and the balance compass or, for instance, a Coca-Cola bottle."

- Modifications eliminating the possibility of smoke in the cockpit due to failure of the engine for the fuel indicator lamp should be introduced.
- "Red" warning is a standby unit for feeding the flight control system and all other hydraulic systems of the Caravelle except the artificial feel unit.

- All down-type altimeters should be checked.

- Crews should receive information on the runway in use, as soon as possible during approach.

- "Ground work" should be modified to prevent inadvertent electrical power loss.

Pan American Asking Bahamas Plan Approval

Washington—Pan American World Airways has asked the Civil Aeronautics Board permission to buy 50% of the stock in newly formed Bant & Bahamas Airways Ltd.

Revel Industries was organized last January to operate among the Bahama Islands. Pan American agreed, pending CAB approval, to provide Bant & Bahamas with technical and ground services as an incentive for a 50% minority interest and the nomination of a Pan American representative to the proposed board of directors.

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AIRLINE OBSERVER

► Kennedy Administration has not decided whether it will raise aviation gasoline taxes and impose a new tax on turbojet fuel. Treasury Secretary Douglas Dillon said last week that the new Administration agrees generally with the Transportation Administration that current fuels should make a bigger tax contribution in view of heavy federal spending for air war, but the issue is still being analyzed. Dillon did say that current aviation fuel revenues be stretched from the highway fund to the general fund where they could be applied against airway costs.

► Air Line Stewards and Stewardesses Assn. has affiliated with the Transport Workers Union, but the feud between ALSSA and its former affiliate, Air Line Pilots Assn., continues. ALSSA says it represents stewards and stewardesses on 25 airlines, but ALPA charged last week that it was the "first in a series" of representation claims in flight attendant groups. The pilot union has 214 of 219 item of American stewardesses, versus a 1964 Motion Picture Board decision, favored affiliation with the new Stewards and Stewardesses Division of ALPA rather than with ALSSA.

► Some Transport Union officials will press for establishment of an air transport division within the union during the annual convention July 1-4 Miami Beach, Fla. Plans for expansion of existing Transport membership in the airline industry are expected to be raised carefully at attracting new membership from stewardess ranks.

► Early reports indicate that transonic test factors during the first two weeks of March may have fallen below the 95% level.

► American Airlines notes fuel weight reduction as the major advantage it expects to realize from its current conversion of Boeing 707s to turbofan propellers. Maximum weight savings will be attained on the New York-Los Angeles run, where the aircraft will fly with 15,000 lb. less fuel per hour because of the turbofan's added power and economy. Fuel load on the turbofan 720B is quite limited, but the lower fuel requirement can still offer a payload advantage in a hot day operation or against strong headwinds.

► General Division of General Dynamics is preparing a proposal for a medium-range turbojet transport to compete with the Boeing 727 aircraft. Prospective airline customers have been told that final specifications for the new aircraft will be available as soon as the current flight testing program on the Convair 440 is completed.

► Middle Airlines, working with Armstrong Whitworth in engineering the first and elevation of its first AW 450 turboprop aircraft with new ribs, seats and struts. Cracking at the engine base on the aircraft, which has kept them grounded for the past month, has been traced to transient vibration and buffeting sustained by the aircraft's wing ribs. Inspection of the modified aircraft will be conducted after each flight until the Airlines have logged at least 100 hr. of flight time.

► Soviet Union is expanding its helicopter operations and within a few months expects to add 100 helicopter routes, including 75 in eastern Siberia. The new routes will boost the helicopter route total to more than 200.

► British Aircraft Corp. has sold three more Viscount 540s to All Nipper Airways and one to Luftwaffe, bringing total Viscount sales to 429 in 1962. All Nipper Airways currently operates two Viscount 744s and will take delivery on its initial order of three 540s only this year. Luftwaffe presently has a fleet of nine Viscounts.

► Douglas Aircraft engineers estimate that the new Series 50 DC-3s, powered by Pratt & Whitney JT3D turbojet engines and equipped with an extended wing leading edge, will have a 30% greater range than present DC-3 models. An increase in long-range cruise speed is expected to make the Series 50 transport the fastest in intercontinental operations. With turbojets, the aircraft will be able to carry a full payload and maintain full cruising on seawater flights up to 5,900 mi. Range can be extended to 5,600 mi. by retracting the wing leading edge extensions.

SHORTLINES

► Bonnet International Airways has begun Boeing 707 service from Miami to Houston, Pittsburgh, via Panama and Lima, Peru.

► Civil Aeronautics Board has assigned Charles E. Serfati of its Bureau of Safety to assist the Argentine government in developing air safety and accident investigation techniques.

► Eastern Air Lines reports the loss of 534 cubic feet after tests last year, the first loss in 18 years. The carrier blamed the loss on a 12-in. x 12-in. hole in the fuselage during a 12-in. x 12-in. hole. The hole was caused by a damaged service, effect of the Eastern accident and the general business recession.

► Federal Aviation Agency will train 20 Air Force men in air traffic controllers in an effort to determine whether FAA should eventually train all military air traffic controllers.

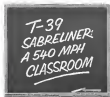
► Federal Aviation Agency has begun flight testing a new antenna which is part of an anti-collision system developed by Sperry (AW Dec. 26, p. 26). The system is designed to provide the automatic exchange of altitude, bearing and range data between aircraft. Another system designed to reduce collision hazard, the AHSR light radar, was reported successful in initial tests.

► Newfoundland has CAA permission to suspend service to Havana until May 8, 1963. National cited the deteriorating political situation in Cuba for declining passenger traffic. In January, 1958, the airline carried 11,189 passengers on the Havana route, compared with 3,648 in January 1961.

► Pan American World Airways has been granted CAA permission to suspend service to Caracas, Newfoundland, until Aug. 18, 1963. Trans World Airlines, whose service to Newfoundland had already been suspended, was granted an extension until that date.

► Sabena has been ordered by CAA to stop exchanging air transportation for advertising, publicity or other services, directly or by using trading contracts, agreements or understandings either written or oral.

► Trans World Airlines will discontinue using number designations, such as 538, 711 and 731, to identify jet fleet. All turbojets will be identified as Convair, Boeing or Boeing International. Suggestions.



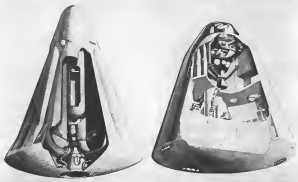
Now the Air Force has a swift, eight-wing jet plane especially fitted for training several student pilots in MANEAT (man operations during the same flight).

The plane T-39 Sabreliner—built by the Los Angeles Division of North American Aviation and already delivered to Tactical Air Command at Nellis AFB, Nevada.

Using the Sabreliner as a radio trainer is another example of how the Air Force gets maximum utility from its equipment at minimum cost. Built originally as a navigation and jet-propulsion trainer, the T-39 is so versatile it can be put to work in many ways by the military services. Its all-around utility and economy of operation truly make it a "workhorse of the jet age."

The Sabreliner, with its modern rear-mounted jet engine configuration, cruises at 540 miles an hour at altitudes over 40,000 feet.





DOUGLAS AIRCRAFT is proposing this nuclear transport system for the booster program. **Right** is a single-stage self-contained propulsion system without expendable parts so that it could be stored, loaded and refueled like an aircraft. **Left** is a multi-stage booster.

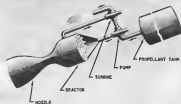
Industry Outlines Proposals for Large

By Edward H. Koles

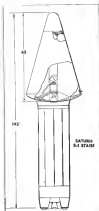
Washington-Kennedy Administration is reaching its decision on the future of the national space program against the backdrop of a variety of nuclear proposals that indicate it would be possible to make a long jump in U.S. booster performance within five years, if there were strong White House support and more extensive use of the nation's technical talent.

House Science and Astronautics Committee, reacting to recent Soviet space flights and their obvious effects on the prestige of the United States, has conducted hearings on space propulsion technology that provided a sounding board for a fresh round of industry proposals on future vehicles (AW Mar 23, p. 20).

The hearings covered both nuclear and conventional propulsion programs, and their production clear evidence that industry believes massive U.S. scientific payloads could be launched by the mid 1960s if a decision were reached now.



POSSIBLE configuration of a nuclear rocket engine to be proposed by Rocketdine on the Navy competition. Company feels that use of a Navy contract by July would permit a flyable nuclear space ship to be ready by 1965.



Below, on the upperstage for a Saturn 5-1 booster.

Booster Gains

to substantially accelerate the national booster effort.

Since Vice President Lyndon Johnson has been put in charge of the national space effort, final decision in this area will have to wait until the Space Act of 1958 is changed to permit him to head the National Aeronautics and Space Council, and until Johnson gets the group organized. When this is accomplished, the alternatives open to the Administration—and to Congress if it decides to move in on the space program—are:

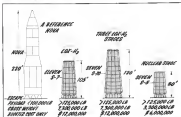
- Reorient the space program to achieve high impulse thrust vehicle systems without changing the Eisenhower Administration's Fiscal 1963 space budget of \$5.17 billion.
- Increase the budget to fund a wider variety of space vehicles than are now being considered.
- Consider the program as accurate reflection of resources and efforts the U.S. should expend in space, and make the changes.

Industry, National Aeronautics and

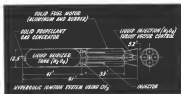
SPACE TECHNOLOGY



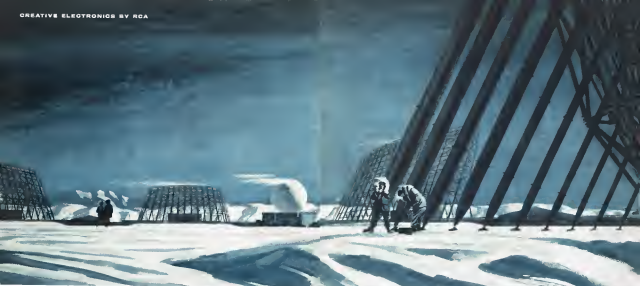
TABLE of large cryogenic solid rocket segments developed by United Technology Corp., showing feasibility of these test using more extensive ballistic shape.



UNITED TECHNOLOGY and Pratt & Whitney are directors of segments forming the booster stage for large payloads with the spent liquid hydrogen-oxygen in upper stage in two configurations and a nuclear second stage on a third vehicle.



UNITED TECHNOLOGY Corp. 200,000 lb. thrust hybrid propulsion system is designed to combine the best features of liquid and solid fuel engines.



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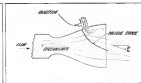
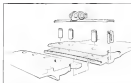
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*Based on Q-2C operations at Air Force Missile Development Center

RYAN AERONAUTICAL COMPANY
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 Ryan Offers Challenge Opportunities to Engineers



LIGHTWEIGHT design port has been developed by United Technology Corp. and Pratt & Whitney Aircraft to connect segments of solid rocket motors. At right, borden here shown is suggested by United Technology Corp. in a means of connecting thrust vector in large solid rockets. An unique shock is induced in the nozzle by injecting a mixture of liquid nitrogen and oxygen.

Space Administration and the Atomic Energy Commission fully agree on the requirement to accelerate action on the nuclear rocket engine because of its great performance advantage over chemically-fueled systems. Industry feels the technological problems of the system can be solved to permit flight by 1965.

Because of funding limits, NASA has scheduled first test flight of the Nerva nuclear engine in 1966-67.

NASA estimates nuclear rocket development will cost \$300 million to \$1 billion, and the 1967 date could be as far as 1970. The current funding pace is quickly accelerated. NASA/AFSCF FY 1965 funding bill total \$47.6 million for the Rover nuclear engine program.

Direct nuclear engine research is funded for \$15 million in the Fiscal 1966 Eisenhower budget.

Solid Rockets Sighted

Although about \$120 million of NASA's Fiscal 1962 money is reserved directly for launch vehicle technology and development, proponents of solid rockets feel the possibilities of this type of propulsion are largely being overlooked. In the preliminary budget \$11 million is for solid Air Force research is doing considerable work with this NASA is large study, including exploration of segmented solid rocket potential.

Much of the technology already exists for conventional propulsion advancement, industry feels, but some technical aspects of the nuclear engine remain unexplored.

Solution of these problems quickly and construction of a flexible engine are seen as the major steps for each use and supporting the Soviet.

F. T. Dixon, vice president of research and engineering for North American Aviation's Rocketdyne Division, characterized major problems as learning how to handle high reactor core temperatures, materials and health

hazards associated with high intensity gamma and neutron radiation, and integration of the reactor into a flexible engine system.

L. R. Kent, Rocketdyne Aircraft Corp. group vice president, told the committee that "we know of no technical problems which might cause a serious delay in the overall development of a nuclear rocket spaceflight system." He said of a Saturn booster and second stage are available and if the nuclear engine connector is selected during 1961, the first test flight can be made during the latter half of 1965.

Nerve Engine Ends

Just NASA/AFSCF action has requested bids due Apr. 5 on the Nerva engine. The action told Avco Aerojet, which is planning to build a contract in the amount of \$1.1 million. The winner is expected to be the single industry source for both non-nuclear and nuclear components for the engine throughout the development program.

Both Rusk and James R. Doolittle, vice president of the Constellation Division of General Dynamics Corp., urge comment, or perhaps feasibility study, design, research and development building, manufacturing and operational use of the nuclear engine vehicle.

Doolittle contends that first nuclear flight can be made in less than 14 months from a decision to construct the program immediately. If the constant cost management concept is used.

The nuclear rocket, at third stage of a vehicle with classified 1.5 million lb thrust Rocketdyne, 11 engines in its first stage, and clustered, 200,000 lb Rocketdyne 32 engines in its second stage could place 190,000 lb in a stationary orbit 70,000 ft on the moon and return and 145,000 lb in a Mars orbit, Dixon said.

Performance of Saturn with 54 boosters powered by eight Rocketdyne B1 engines 531 second stage, with four 12 engines and nuclear third stage would be 80,000 lb in a low earth

orbit, and 51,000 lb in an escape trajectory, Doolittle said.

Although test and flight use of the nuclear rocket engine, which will be in third stage of Saturn, Douglas Aircraft sees the nuclear space engine as the propulsion system for an unmanned space transportation system called Rites (for reusable interplanetary transport approach).

Douglas Rites Concept

Three-part Rites program, which could cost over \$1 billion in complete, would have a flight test using a two-stage-boosted engine in 15 months and first nuclear-powered flight test in 1965, and would be performing lunar missions by 1966-67.

The program's operational schedule, however, would depend on the Rover/Nerva program.

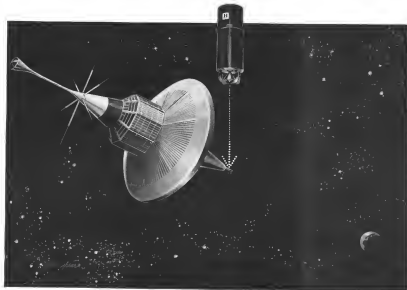
Development would consist of three vehicles.

• **Rites test vehicle**, using a Pratt & Whitney J581-19, 15,000 lb thrust engine to light test the unsuited Rites configuration and systems. As nuclear components, various the rocket motor and stack systems, including 11 engines could begin the test, and ballistic and orbital tests using an advanced Thor booster would begin in January, 1965. Pre-test recovery control, using Bell Helicopters, planarized radio guidance, systems, would be qualified during these flights. Rocket, called Thor-1, a Thor with four coast rockets attached to the aftmost.

• **Rites-A**, which would make use of the first nuclear engine available, with its use tested to accommodate this engine. Present concept is a cone-shaped, 40 ft in diameter at the throat and 45 ft high. Vehicle checkout would involve launch in a single stage in ballistic and vertical trajectories. An second stage, on a Saturn B1 booster, at could cost \$5,000 lb or less 10,000 lb on the moon without refueling. Object of Rites-A is to consider the effect Rites

Honeywell's IR Horizon Scanner

"Sees" from 100 to 60,000 miles



Intensive research and development on the use of infrared for space exploration instruments gets special emphasis at Honeywell's Los Angeles Optical-Electronics facility.

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IR Detectors Typical Honeywell IR detector and preamplifier combination. The PSM (photo-voltaic sensor) cell operates at ambient conditions, non cooled, and has a spectral response from 2-6 microns. Honeywell also produces cooled detectors for military and space applications.

Communications Honeywell's NUCSECOM (Nuclear Security Communications) provides voice or coded intelligence via modulated infrared energy. Line of sight communication with accuracy and throughput as high as 100,000 words per minute. Solid state electronics and semiconductor modulator unique to NUCSECOM provide for compact, rugged, portable receiver designs. "Continued"



Radiometers Honeywell has produced infrared radiation measuring instruments (the picol detector) for a wide range of applications (the also optional) based from 0.7 to 40 microns.

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Here twenty-five million electron volts probe the inmost secrets of a missile

Vastly more powerful than any known industrial X-ray apparatus, the Beteon yields a clear picture through the full path of the third-stage Minuteman engine in an eight-minute exposure, contrasted with more than a nine-hour exposure required with 1,000 curies of cobalt 60. Resolution is such that irregularities down to 0.01 inch can be examined. Power of the instrument, and dimensioning of the building which houses it, are more than equal to the task of scrutinizing interior topography of the most complex double-base solid-propellant motors made at Bechtel: the third-stage Minutemans, advanced second-stage Polaris, Atlas, and the others.

SP-1



Chemical
Propulsion
Division

HERCULES ROCKET COMPANY



Minuteman
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For more than a quarter century, Hallcrafters has worked in close partnership with our armed forces on fast solutions to critical military electronics problems. Out of this priceless experience are emerging startling new ideas and hard-hitting, fast-moving techniques to keep our country one jump ahead in electronic warfare. . . .



E-1 and nine military aircraft will be powered by the new engine. Electric drive systems will be used for the aircraft's auxiliary power units, and the aircraft will be able to operate in the air for up to 10 hours. The aircraft will be able to operate in the air for up to 10 hours. The aircraft will be able to operate in the air for up to 10 hours.



Efficient communication bandwidth is provided by our high frequency single channel system, limited to 32 100, 000% module design as well as single modulation for bandwidth with existing and future communication systems. Finally, with proper system design, it is better than any other in 1000 Hz per second, facilitating also other in creating capability in receiving and transmitting bandwidth up to frequency of 100 Hz, maximum.



Exhaust schemes and noise were improvements with power capacity is needed. In 1990, WGL and its main reasons is that because of its very high power handling requirements. Testing of new more convenient is possible with quick high power generators designed and built for hydro.



Availability of support and training is another essential element in ensuring that maintenance staff will use and maintain safety programs with full confidence and control. The most likely project specialty teams Maintenance and Technical Support Teams should use include, but not be limited to, personnel trained in emergency response, investigation and testing of electrical equipment systems operations at the world.



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and create a series of expensive, solid, as he built in dry basins and floated to the site, he said. An aggressive space program based on solids could bring gross vehicle weight cost to about \$1 per pound, Condon claimed.

Proper Application

Rocketdyne President S. K. Hoffman feels less and "is not an exclusive advocate of any one type" of propulsion systems, but will apply to the one best suited to the need. In an analysis of merits of each system, he said solids are best used in tactical and strategic applications and for accuracy and JATUs, but liquid and nuclear propulsion must be used for more complex missions.

Hoffman says recovery of liquid hydrocarbons developed to the point where they can be used 90-100 times, which would reduce the cost of handling space missions essentially to the cost of the propulsion.

Broader effect in all areas of propulsion was urged by Aerojet General Corp. President Don A. Kershall, who said inadequate support of advanced components and concepts "has been a constant weakness in our ability to advance rocket technology."

Kushall labeled the present space program "merger" because of small-scale booster capability and suggested acceleration of these projects to suggest a

• **Segmented rockets:** Aerojet is now conducting a USAF program which could lead to a segmented solid in 2-3 years, able to deliver 2.53 million lb thrust for 60 sec. Major problems is basic nozzle development.

• **Pressure-fed engines.** Although heavier and not competitive with pumped engines in ballute modules, they are simpler to build, cheaper, highly reliable, and have high performance characteristics in space applications. The earliest pressure-fed engine—cold-diesel—weighs 15.23 million lb thrust, just 150,000 lb in weight, and is completely uncooled.

* **Rooster recovery:** development of massive landings at flyback is terms based on reliable structures or Rogallo wings could reduce the cost of an airframe payload from the present \$1,000 per lb. to \$450 per lb.

NASA's top program officials wanted the committee to state that the agency is not biased against solid propulsion, but Rep. Victor L. Antonio (D-N.Y.) asked that an impartial study be made for the committee by NASA on solids and liquids. Maj. Gen. Elton R. Osterlander, NASA launch vehicles director, who agreed to the study, said he has recommended that the agency increase its support for solids from \$3 million to \$10 million, and increased liquid rocket funding from \$66 million to \$83 million in the fiscal 1963 budget.

AVIATION WEEK, March 22, 1992

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PERFORMANCE of the Boeing 720B is improved over its predecessor 720 because of a 40% increase in available thrust with only a 15% increase in allowable gross weight. First 720B at the production line for American Airlines is shown just prior to a takeoff.

Aviation Week Pilot Report:

Turbofans Reduce 720B's Takeoff Roll

By Wilton S. Reed

Seattle. With—better takeoff performance, lower fuel consumption and higher payload-carrying capability—are the most notable features of the Boeing 720B which enters American Airlines' service this month.

Thrust increase of 40% supplied by the four turbofan engines enable the 720B to cruise at 670 mph at 25,000 ft; take off from one third less runway than the 720 at comparable weight, and 18% less fuel at comparable speeds and altitude at a gross weight 20,000 lb. in excess of its predecessor 720.

Improved performance, most notable of which is a short takeoff run and rapid climb, was demonstrated during a recent American West plane flight in a 720B at Boeing Field. Ability to operate from high altitude airports will permit American Airlines to offer service into Mexico City's 7,143-ft-high airport (AW Feb. 27, p. 32).

The flight included a summary of the maneuvers illustrating handling qualities in Boeing's customer training program, given by Paul Murr, experienced test pilot and customer district instructor.

Only external differences apparent between the 720B and the 720 are in the larger engine nacelles and in its increased horizontal stabilizer area. Second floor on the right was N7514A, the 4th 720B off the line for American Airlines. With 12 persons and 16,000 lb. of fuel on board, the aircraft gross weight was 166,750 lb. Maximum allowable takeoff weight of the 720B is 215,000 lb., maximum flight weight is 251,000 lb.

Weather prevailing at Seattle's Boeing Field on the day of the flight was temperature 50° (44°) and from the east at 15 kt., altimeter 30.15, sea conditions 4 to 6 with intermittent drizzle.

Pre-Takeoff Calculations

Pre-takeoff calculations showed that specific loading conditions with the center of gravity at 24 mean aerodynamic chord called for the following settings: elevator trim, 2 deg. nose up; engine power, 1700; flaps, 10; ratio of total turbine exhaust pressure to

total engine inlet pressure—1.75. V, gross (maximum) 161 kts.; V₁, speed, 162 kt.; V₂, speed 175 kt.; V₃, speed 170 kt. The aircraft with Captain Scott, Boeing's chief production test pilot, in the left seat and Murr in the right, was taxed to position on Runway 11. Murr did the taxing from the right seat demonstrating that nose wheel steering is not needed for control on the ground because of the centering action of the nose wheel.

Performance of the 720B, on one



MAXIMUM ENVELOPE diameter of 17,000-lb thrust Pratt & Whitney JT3D-3 turbofan engine is 44 in. greater flow duct of the JT3D-3 nacelle which powers the 720. Bypass air acts as an aerodynamic cushion for the exhaust, clearing the road for sound suppression.

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person with the straight 738, expands it as high as 100 ft, is impressive. The 738, with Pratt & Whitney JT1C-7 engines developing 17,000 lb, thrust in a good performing aircraft (AWW Aug. 15, 1960 p. 58) but the D model has over 40% more power. Its 180-hp JT1C-7 engines each develop 17,000 lb, thrust providing very rapid acceleration to takeoff and very steep second segment climb. Fine angle, in fact, probably exceeds that which the airlines will ever be able to power. After all, he is not a pilot and power will be reduced or ramped off if he finds that the aircraft is not as good as he expected for regular operation.

No effort was made to refute the numerous performance, climb and the aircraft rate at an indicated speed of 310 kt (true climb speed) for cruise. With the 738, the aircraft could climb at 10,000 ft, exhibiting a 4,000 ft/sec rate of climb. The 738 could climb through 15,000 ft, one minute later, through 20,000 ft, two minutes later, and reached 30,000 ft, easily, 18 min from start of takeoff. Climb power was 180% of 100% with EPR of 1.7. Fuel flow weight rate of climb is estimated at 1,500 gpm.

Maer and Scott tested the aircraft

off at 10,000 ft to conduct various checks, mark the time of the aircraft and the functioning of engine stage bleed valves.

The aircraft settled down to a cruise speed of Mach .58 (roughly 397 mph) at 30,000 ft with the following subsonic EPR: 1.53, N: .97%, indicated fuel flow: 1,100 lb/hr/engine. Indicated airspeed was 370 kt and indicated true airspeed was 339 kt. Scott then relinquished his seat to this pilot and Maer resumed his demonstration of the aircraft's shortcomings and capabilities.

Time did not permit a complete rundown of Maer's remarks but it did elude the more important aspects of the many qualities typical of large, high-performance, steeply rising aircraft. It is probable that climbing out on pilot, Maer demonstrated all the general handling qualities and maneuvering, together with the proper procedures and techniques. Students are advised of these abilities to cope with the machine and enhance the transition course with greater confidence and better understanding. Maer says.

First time was a demonstration of the cruise capability of the aircraft. Power was boosted slightly and the aircraft accelerated quickly to the point where the Mach limit warning bell sounded, approximately .91 on the Machmeter, actually, 908. Shortly be-

Environmental conditioning for missile ground support systems



AiResearch electronic cooling units for U.S. Army Hawk missile mobile ground radar equipment require only half the space originally allotted. These lightweight products come with a heat rejection capacity of 10 KW, measure 20" x 24" x 3".

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CONTRACTS formal at \$7,000 ft during Aviation Week flight in Boeing 738B over Washington state. Note engine ducts for bypass air from forward fans, and forward and aft horizontal stabilizer to compensate for destabilizing influence of 40% power increase.



JetStars Move Down Production Line

Luxford JetStars move down the production line at the company's Marietta, Ga., plant. Deliveries are scheduled to begin next year on commercial orders with the first at six Whittier Air Transport Service special air mission C-140 JetStars to be delivered in September under M-400,000 contract. MAIS selected another five JetStars for checking aircraft. Luxford has five of the aircraft in backlog, as in FAA certification program.

off axis of 1.1 ft/sec/sec established in tests. But no noticeable g force was applied. Roll-in was single occurring at about 115 kt, followed by a ten degree roll at an indicated speed of 40 kt. A mechanical stick shaker activated at about 115 kt. The 7700 exhibited no failures to fall off on a wing nor were there any increase deceleration oscillations.

Scatterings were based after the aircraft was slowed by. While main winging (14900 ft), maximum constant power was applied. Thrust was started when the aircraft passed through 100 kt and the acceleration to 400 kt took 15 sec. Again, the aircraft was used 40,000 ft. In order to maintain weight but this indicates the cockpit's climb potential at this altitude. A pilot claims that this is an aircraft with more reserve power than is usually available in transport.

Longitudinal pitch changes caused by spoiler activation were tried in order to demonstrate how loadings can be accomplished with a powered stabilizer

Two switches on the overhead panel guarded to the "on" position roll de-activate either the roll-in or roll-out spoiler. With the overhead master switch, activation of the spoiler brake handle causes the roll-out spoiler to be deployed, producing a nose-down pitching moment. Opening the switch on the overhead panel, a nose-up pitching moment. When used in combination with at least 70 deg. of flap, roll-in pitch behavior, the spoiler activation switches and the speed brake handle produce effective longitudinal trim changes sufficient to enable a landing to be made.

Maneuvering power with two and two engines on the same side out back, to allow maneuvering that angle power was available to compare flight and that roller control is sufficient for all normal maneuvers. Roll-in force appears to be about the after the initial 40 kt. In use, is applied to bring the roller back into play with the van damper out in. Without the pre-

dictor, 12 ft of pressure is required. Result is that with sudden power loss, a marked tendency exists to apply too much corrective rudder. Also, in maneuvering the aircraft, too much rudder can easily be applied resulting in uncoordinated maneuvers. This could lead to Dutch roll at altitude. Without a positive gradient reference must be made to the instruments to maintain coordinated flight. Rudder force gradient built to allow specifications is not suitable compensation though. Turns with one and two engines are not made comfortably without undue strain on the pilot's legs and without the need for constant trim. During the 7700 on instruments proved to be a pleasant experience. An overcast moved in at 12,000 ft during the flight, necessitating an instrument landing to about 4000 ft. Following Scenic Approach. Control's instructions, a landing pattern was maintained for about 15 min, following which a standard radar monitored descent was made. Throughout the landing, 50 deg. of bank was used. Ease of operation was apparent and the American Airlines flight instrument arrangement proved to be conducive to a minimum of confusion. The descent through light icing and moderate turbulence proved to be less than difficult. This change proved to be normal with changing power and speed.

Then, landings were made on this flight with two being performed from the left seat by this writer and the first done by Mary demonstrating a "break off" touchdown. Reference speed V_{ref} for the lowest speed at a gross weight of about 125,000 lb. was 117 kt. The pattern was flown at about 145 kt with speed reduced to 125-130 kt on the final slope.

Two characteristics have to be kept in mind when landing the 7700:

- **Retard overcontrol** on the final approach is easily induced by the pilot if coordinate power is held too long. As in the Dutch roll description, the activation of the aircraft makes it necessary that reactive action applied to pull up a wing not be held until inertia starts. If a wing drops slightly due to a gust, opposed to be applied but the correction removed before opposite roll starts. Once the proper action and sensation is learned, lateral control is not difficult but the untrained pilot was at a disadvantage in the above when the aircraft maneuvers was held with reactive action.

- **Flareout** is activated with two aircraft on landing, but the aircraft is not held off in speed descent. Rather a constant attitude is maintained. The active angle is not increased. If an attempt is made to hold the aircraft off a bad landing will result because the main gear is off of the center of rotation.



Computer-operated laboratory model of pilot's display of aircraft landing area within the limits of safe landing

FAST THINKING for spacecraft pilots is the development objective of the Bendix Energy Management System Project being carried out for WADD, ARDC, United States Air Force. By means of an airborne computer-operated electronic display, a pilot will see the continually shrinking area of targets and landing sites which he can reach without exceeding the acceleration or heating constraints of safe flight. Career opportunities in such advanced projects are available to engineers who would like to direct their energies most effectively.

BENDIX SYSTEMS DIVISION

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SIX MONTHS FROM CONTRACT TO COUNTDOWN

Just six months following contract award, Northrop began delivery of Datico automatic checkout equipment for use in the Navy's Polaris Fleet Ballistic Missile program. Datico is used in factory, depot, tender, and submarine operations.

Datico is a digital automatic tape checkout system with a wide variety of applications. Its successful integration by Northrop into the Polaris and other major weapons systems demonstrates that the same basic Datico equipment can be used at all levels

of maintenance and operation, utilizing the same test standards and methods and operated by personnel with the same basic training.

Northrop is at work on more advanced versions of Datico to extend its capability to an even wider range of military and industrial systems.

NORTRONICS
a division of
NORTHROP

time and holding off results in driving the main gear into the runway. Consequently, good landings can be made by allowing the aircraft to settle onto the runway while maintaining the same attitude that was established on the approach.

The third landing was executed by Nasser from the right seat. With only minor corrections applied by Nasser pressing in the control rods as final approach, the F-5B coasted to a halt about 30 ft above the runway. At this point, Nasser cut the power and allowed the aircraft to settle onto the runway without further assistance. Although not as smooth as the second landing made, this demonstration graphically demonstrated that too much effort on the part of a pilot can ruin the aircraft. Difficult to land.

After about 1 hr of flight, the aircraft was towed back to Boeing's Conversion Flight Center. Ground handling was conducted without difficulty, with visibility in good as that experienced in an large aircraft.

PRODUCTION BRIEFING

Lockheed Aircraft Corp.'s first P-3V-1 ASW aircraft rolled off its California Division assembly line recently. Powered by two Allison turboprop engines, the 400-hp-plus aircraft will begin flight testing soon.

Block Instrument Corp., College Point, N. Y., has received a \$993,900 Navy contract for remodeling of unspecified components for the Aeroshell submarine rescue program.

Curtis-Wright Propeller Division, Caldwell, N. J., will begin manufacturing variable exhaust nozzle, control equipment for the General Electric J85 turbojet engine. The \$1-million contract is for controls on engines powering the Northrop T-38 jet trainer.

Tron Casco Co., Buffalo, N. Y., will produce line, rollers and spool units for the Boeing C-119 jet cargo aircraft under \$1.5-million contract. Production under the contract begins on April, 1961, to June, 1962.

Greenwood will build additional W-21 carbonized cathetering on craft under a \$380,000, Russian Air Weapons contract. The W-21, powered by two Allison T-56-A8 helicopters, is designed to replace the earlier piston engine Greenwood W-2 in fleet early warning aircraft.

Booth Aircraft Corp. has received a supplementary contract totaling \$1.7 million from U. S. Army for design and production of Model 1021 target drone, extending that work with Felt-



SAC 8-58 Crew Receives Thompson Trophy

8-58 crew members of Strategic Air Command's 79th Air Division are awarded the Thompson Trophy for their 1,214 mph performance over a 1,800 km closed course, setting a new world record for this event. Shown left to right are August Eisinger, executive vice president of General Electric; B-57 commander, Eugene Chaffee, executive vice president of Thompson Engine Works; sponsor of the trophy, Maj. Harold Custer, pilot of the B-57; Capt. Elwood Fisher, defense systems operator, and Maj. Richard Wein, navigator (AW News 6, p. 17).

man, 1962. Model 1021 drone is Army's version of the Navy KDB-1 missile target.

Southwest Aerospace Corp., Dallas, Tex., has received a three-year contract covering helicopter engine overhaul from U. S. Army Transportation Materiel Command, Ft. Lee, Va. Ford, Inc. (C-130 engines for B-1B and C-130A engines for B-1B and B-1C) will go on the Southwest Aerospace, will build two in May and contract calls for maximum of 135 engines to be overhauled in the first four months of next. Contract work Southwest Aerospace's cuts, says Army aircraft engines overhaul.

General Division of General Dynamics Corp. has received a \$566,120 USARF. An Research and Development Contract award contract to develop and test a pneumatic flight control system for high performance aircraft and missiles. The two-year effort will be conducted at San Diego. The flight control system is to operate in the presence of high temperatures and high noise reduction levels. Present hydraulic systems are inadequate to meet this contract need.

Advanced Technology Laboratories, Menasha, Wis., Calif., received a let by contract from Boeing Airplane Co. to develop prototype sensor device for measuring skin temperatures in the Dyna-Bee manned space glider. Sensor will give the pilot critical temperatures

data during the glide into the earth's atmosphere and Boeing calls it one of the most important systems in the glider development program. The \$36,000 contract also calls for the development of a method for simulation of the system.

Adcock-Ming Co. (General Electric) has been awarded a three-year contract by the Space and Information Systems Division of North American Aviation, Inc., to investigate thermal and atmospheric control of space vehicles. Adcock-Ming will study the requirements, design concepts and integration of environmental control systems.

Navigation Division of the Northrop Corp. has formed a marine equipment department to develop and produce prototype electronic systems, stabilization computers and navigation systems (see plotting equipment). The new department will operate in Newport, Miss.

Knackert Division of General Precision Inc., Little Falls, N. J., has received contract totaling \$5,251,300 from General Division of General Dynamics, Inc., for design and production of precision rate integrating gyro for the Atlas.

General Electric Co.'s \$15.5-million Mark II Telescope Measurement System, now being developed for the Navy under QMLC contract, will incorporate as its primary commercial gyro link.

FUEL HANDLING

B.F. GOODRICH PRODUCES THE ANSWERS



SURGE HOSES—absorb hydraulic shock

FLEXIBLE CONNECTORS—for internal fuel lines

The aerial refueling system on the U. S. Air Force KC-135 jet tanker delivers fuel at an extremely high flow-rate—yet must disconnect instantly when required.

To make the tremendous shock pressure when flow is interrupted, B.F. Goodrich designed and built for Boeing a double-walled surge hose to carry fuel in the flying boom extension. A pressurized air cushion between the walls of the hose dampens shock loads, permits fast refueling with safety.

B.F. Goodrich designs and produces special products for a wide range of fueling requirements—surge boots, flexible fuel line connectors, fuel cells, hose, vapor burners, and

others for aircraft—motor cases, transfer lines, and solid propellants for rockets and missiles. For help in your application check *B.F. Goodrich Aviation Products*, a division of *The B.F. Goodrich Company, Dept. 4W-3B, Akron, Ohio.*

PRESSURE SWITCHES—BFG switches actuated by pressure. Goodrich designs includes problems many critical functions on jet engines such as indicating adequate fuel pressure, actuating afterburner igniters and monitoring waste air controls.



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EXPULSION DIAPHRAGM—BFG supplies a special flexible diaphragm mounted in the fuel cavity of the Bonarr supersonic area defense missile. Diaphragm seals hydrocarbon fuels under pressure to external jet engines.



WEIGHT-SAVING FLEXIBLE FUEL CELLS—The T-38 jet trainer, made by Northrop, is one of many current aircraft using BFG fuel cells. Constructed with special low-resistant compounds, these cells are strong and lightweight. BFG fuel cell manufacturing is backed by complete development and test facilities.

SOLID FUELED ROCKET MOTOR CASES—BFG offers complete capability in glass-reinforced rocket motor cases—also caselites. These glass fiber reinforced plastic structures are lightweight, strong, and are produced in many sizes and configurations.

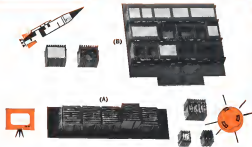


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AVIONICS



ANTENNA INSTALLATION on KC-135 jet tanker used in recent tests of atmospheric scatter for ground-to-air communications. Tests were conducted by Air Force Cambridge Research Laboratories. The scatterer, three aircraft were used on each wing tip, providing space diversity reception. Two transmitting antennas were mounted on vertical stabilizers and on aircraft's nose.

KC-135 Tests Ionospheric Scatter VHF

By Philip J. Klein

Feasibility of using ionospheric scatter for two-way, ground-to-air comms at VHF frequencies in distances up to 1,500 mi. has been demonstrated by a series of recent tests conducted by Air Force Cambridge Research Laboratories.

During a period of several days, tests were conducted which showed that ionospheric scatter can be used for two-way, ground-to-air comms at VHF frequencies in distances up to 1,500 mi. has been demonstrated by a series of recent tests conducted by Air Force Cambridge Research Laboratories.

Development Tests

These tests are the first in a series of developments which emphasize that ionospheric and tropospheric scatter techniques are not limited to point-to-point service as a means for using VHF and UHF over distances far beyond line-of-sight ranges. The effort includes:

- **Path America, World Airmen** and U. S. Navy have conducted two-way ground-to-air communications at VHF between Colorado and Hawaii, a distance of 1,500 mi., using "side ducts" produced by tropospheric scatter, and by ionospheric scatter for longer distances (AW Feb. 6, p. 58).
- **Path America** presented the ground-to-air of tropospheric scatter with a distance of 1,500 mi. (AW Feb. 15, 1955, p. 46).
- **Acoustic Radio, Inc.** has achieved two-way VHF over communications with aircraft at distances up to 150 mi. using a tropospheric scatter

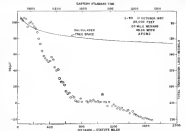
path. (AW Feb. 6, p. 91).

• **Federal Aviation Agency** plans to install two experimental tropospheric scatter systems in Colorado and Newfoundland to extend the original PAA tests and coverage.

The recent AICRE tests, using a specially modified KC-135, showed that 60 watt permanent telegraph service with low error rate, both ground-to-air and air-to-ground, can be achieved com-

munications at 1,200 mi. by ionospheric scatter. Ranges out to 1,500 mi. can be obtained under favorable conditions, at the expense of a modest increase in error rate. AICRE tests indicate that ground-to-air comms can be conducted using a frequency of about 30 mc.

When ionospheric and tropospheric scatter techniques were developed less than a decade ago, discrediting the previous line-of-sight range limits of VHF and UHF, they were considered a tech-



POSSIBILITY of two-way ground-to-air communications at VHF has been suggested by results of field strength measurement tests conducted by Air Force Cambridge Research Laboratories in 1957 on a KC-135. Measurements were made at 49.25 mc.

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Atchley's servovalve is known for its precision, reliability, and ease of use. It is a jet-pipe type valve with a built-in check valve. It is used in a wide range of applications, from aircraft controls to industrial automation. It is a small, compact unit that can be easily integrated into existing systems.

enlarged bandwidth at point-to-point communications. Tropo-scatter could provide wideband voice service out to distances of several hundred miles, while (unclassified) scatter provided narrowband service out to distances of about 1,000 mi. But the extremely high-powered ionospheric and large antennas required, particularly for ionospheric scatter, made it seem unlikely that it either could be used for ground-to-air communications.

In 1957, AFCEC scientists decided to investigate the possibility of using ionospheric scatter, spurred by the needs of the Strategic Air Command for reliable communications with its aircraft operating in the Arctic in the face of blackout of normal HF radio service during ionospheric disturbances.

Using a specially constructed 5-M, AFCEC scientists first made a series of flights to obtain data on pulse loss of signal strength as a function of distance and altitude. From these measurements, AFCEC scientists concluded that there was a good possibility that two-way ground-to-air relay service could be provided, and plans were laid for the subsequent experimental tests in a KC-135.

Airborne Ionospheric

In drafting one of the two test flights from a ground station to an aircraft there are a number of problems that must be solved. The ground station can no longer use the same equipment, highly directional antennas, because the aircraft is in motion and its position must not be known in advance. For ionospheric relay, the aircraft must operate with relatively small low gain antennas and a compact, efficient transmitter which is as powerful as a ground station's transmitter.

To make up for these limitations, AFCEC scientists resorted to clever techniques to boost performance. The ground station, located at Waltham, Mass., employed three-stage frequency direct conversion. The space-to-air pulse transmitter used a 10 mHz radio device. The first 10 mHz stage segment at pulse was transmitted at one frequency, the second 10 mHz segment was transmitted at a frequency offset 30 Hz from the first, and the third 10 mHz segment was offset again by 30 Hz. Ground-to-air power output was 50 kw. Transmitting antennas consisted of a vertically stacked dipole with a gain of about 17 db, giving broad coverage coverage, while receiving beam in vertical direction.

A separate receiving site was located at Littleton, Mass., about 20 mi. from the transmitter. Six receiving antennas and a delay receiver unit used to provide a field space diversity reception.

The KC-135 also employed space diversity in its antenna installation. For



America's FIRST man into space will rely on a Honeywell designed and developed Attitude Stabilization and Control System for controlling his space capsule. This system automatically dumps out initial launch rates, orients and maintains the capsule in proper orbital plane, and provides for the correct descent trajectory and re-entry angle. This device is just one of the many contributions being made by Honeywell scientists and engineers to our nation's space program.

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Senior Systems Development Engineer—Experienced in electronic systems and sub-systems. Capable of translating requirements into block diagrams and block diagrams into circuits.

Senior Mechanical Development Engineer—Experienced in electro-mechanical design with gyro or platform design and analysis.

Send your résumé listing your areas of interest, or request for further information to: Mr. Clyde W. Himm, Technical Director, Aeronautical Division, 2616 Ridgeway Road, Minneapolis 40, Minnesota.

To explore professional opportunities in other Honeywell operations, visit us soon, and your position on our staff is: Mr. H. E. Eklund, Honeywell, Minneapolis 40, Minnesota.

SILICONE NEWS from Dow Corning



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Reliable... that's one word new up the record established by the Army Jupiter and the performance of Silastic®; the Dow Corning silicone rubber is part of that record.

Rubber ducts must not crack even though frozen hard and brittle by liquid nitrogen. Across duct walls must remain a rubbery seal despite high static temperatures. Rubber parts must be "ready-to-go" even after long storage without signs of aging cracks. Chrysler Missile Division engineers specified Silastic to help keep the Jupiter ready... Silastic. Available from... 113 to 500-F and options in storage.

Photo courtesy Chrysler Missile Division

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Dept. 2616 for
information



Dow Corning CORPORATION
MIDLAND, MICHIGAN

AiResearch pressure suit cooling unit

*provides maximum pilot
comfort on the ground*



This portable, lightweight package keeps the pilot cool and comfortable on the ground as he has flight pressure suit from one to two hours. Utilizing cryogenic liquid oxygen as the coolant, it requires an electric power as either connecting supplies which might hinder the pilot's mobility.

Easily carried by hand or slung from the shoulder, the AiResearch unit can cool a pilot wearing either full or partial pressure suit during travel in and from his aircraft, preflight checkout and while seated in the cockpit. Pure oxygen for prebreathing can also be provided as a simultaneous function.

This extremely simple and reliable cooling unit has no moving parts. In operation, ambient air evaporates a supply of liquid oxygen to preserve the system. Cooling air, made up of stored oxygen and ambient air, is then circulated through the suit.

AiResearch is now in production on self-contained life support systems capable fully without protection suits. These suits allow the wearer to work safely in hostile environments such as toxic smoke, fuel handling and fire fighting. Research for modifications of these systems is now being conducted for space use.

* Please direct inquiries to Los Angeles Division



AiResearch Manufacturing Divisions

Los Angeles 45, California • Phoenix, Arizona

Systems and Components for AIRCRAFT, MISSILE, SPACECRAFT, ELECTRONIC, NUCLEAR and INDUSTRIAL APPLICATIONS



GROUND STATION ANTENNAS employed in ionospheric scatter ground-to-air communications tests include transmitting antenna field, using a vertically stacked dipole which gave broad azimuth coverage but complete isolation in vertical direction, and an receiving antenna, one of three visible in photo (right), which provide space diversity against for receiving scatter transmissions.

wireless, a three-element array with a gain of about 6 db was mounted on each wing tip. (See photo.) For tests cutting, antennas with a gain of about 7 db, were mounted on cable side of the aircraft's vertical stabilizer and nose, also providing dual space diversity.

The aircraft was outfitted with a 5-lw. transmitter, built by the Martin Co., and two 10-lw. units, one built by Cushman Electronics and the other by AFRL scientists. These are the most powerful transmitters ever operated aboard an aircraft, according to AFRL scientists.

The aircraft was equipped with dual space and angle-diversity receivers, a seven-channel teletype and console. Conventional frequency shift keying (FSK) was employed, but using a frequency shift of 6 kc to avoid problems of station and reflecting display shift. Band synchronism (quarter-wavelength) detection was used.

Flight Tests

Flight tests, which began in November 1959 and were completed last year, encountered considerable problems with noise in the receiving antenna produced by static discharge. Below the altitude of the tropopause (16,000 to 18,000 ft.), noise in the wing tip receiving antenna was 40 db above normal ground background noise, dropping off sharply to 10-15 db above

ground background when the aircraft was above the tropopause altitude.

(The AFRL scientists may have unwittingly selected a location and antenna configuration which served as an effective static discharge device. In turn of a wire type static discharge device developed by Standard Research Institute, which bears some resemblance to the KC-115 antenna configuration. SRJ found that the wing tip was an ideal location for discharging accumulated aircraft charge.) (AW May 14 1960, p. 52.)

Because of these noise problems, and the fact that the transmitting antennas in the nose and vertical stabilizer were relatively narrow beam, they were also used for receiving. For this reason, it was not possible to carry out simultaneous two-way communications during a single flight.

AFRL scientists conducted successful ground-to-air teletype communications during 14 of the KC-115 flights, and air-to-ground transmission during nine of the flights. Received power level for aircraft to 30 north from Bedford until loss of signal occurred, then turned around and flew back.

Equipment aboard the aircraft, and at the ground terminals, recorded both signal level and the strength of received teletype characters for subsequent error count analysis.

During one period of extreme solar

activity, which had blocked out HF communications, the KC-115 made a double pass.

Communication was not only maintained out to nearly 1,500 mi., Anaheim, Wyo. was said, but the signal was actually stronger than normal at distances beyond 500 mi.

Most likely explanation of this phenomenon is that the Doppler of the ionosphere, which is believed to be responsible for scatter propagation, undergoes increased ionization during a solar storm.

AFRL scientists already have ideas for improving noise performance, if it should be adopted for operational use. With improved design of the airborne antennas and better siting at the ground receiving antennas, as much as 3 to 5 db could be gained. AFRL scientists say.

Raising the power level of the ground transmitter from the 50 kw used in the tests to as much as 500 kw, which is now possible, would provide a major boost in performance. Improved cooling for the airborne transmitters, is feasible in to deliver its full 20 kw continuously, could add another 4 db to system performance.

The AFRL ionospheric scatter program was carried out under the general direction of Edward Dagle and Arnold Oswego of the Electronics Research Directorate.



INFRARED SPECTROPHOTOMETER is a Perkin-Elmer modification used in Army research project. At left are high-voltage power supply and electronic units. At right are carbon arc light source and adjustable mirror (in housing) to control angle of incidence of light falling on sample area. Sample and reference beams are compared and results recorded on slit chart.

Airborne Infrared Monitor Studied

U. S. Army is studying the feasibility of an airborne infrared monitor which will permit high-speed scanning of the ground below in continuous monitoring of the terrain's infrared reflectance values.

Offices and sub-data could be transmitted electronically to a computer which would convert them when necessary into direct, accurate indications of the actual situation, and its suitability for heavy traffic, such as tanks, trucks and special weapons vehicles.

Work is under way at U. S. Army Engineers Waterways Experiment Station at Vicksburg, Miss. Army said if the studies objectives are attained, the future study project could gain potential in commercial applications in exploration for oil, minerals and other subsurface deposits.

Instrument involved in the tests was developed by Perkin-Elmer Corp., and is a modification of one of its standard spectrophotometers. In equipment, it has a carbon arc source and additional optics.

Intent is to establish diffuse reflectance characteristics of various types of ground cover, such as vegetation, soil, slope and moisture. Sample plots of terrain types now are being analyzed with the Perkin-Elmer device to determine correlation between infrared reflectance and structural characteristics.

Current plans involve only ground-based instruments. If feasibility is proven, proper will study development of similar units for airborne use.

To assure maximum sensitivity, Perkin-Elmer engineers modified the instrument to make use of three detectors over a 0.15 to 5.00 micron area. Photo-multiplier is used from 0.75 to 0.77 microns, lead sulfide detector from 0.77 to 2.35 microns and cooled silicon extrinsic detector from 2.35 to 10.0 microns.

Scanning is automatic and varies in speed from 2 mm to 512 mm per optical wavelength coverage. Detectors and optics are switched automatically during forward and return work, split servo controls for detector scan rates and source characteristics and thus provides a constant reference channel signal.

In the modification, the optical system was altered to provide uniform collimated light on the terrain sample at angles of incidence from 15 to 70 deg. Double-beams system eliminates all atmospheric effects.

These differences between the three detectors and their gain amplifiers are eliminated, colored electronic multiplier is used to produce a d.c. output for the recorder and another reference signal is automatically phase-shifted to keep it in phase with detector signal.

Re-entry simulation and material test services are two of the many activities now being conducted at Plasmadyne's hyperthermal test facility. One of the company's products, an arc plasma generator, is used to simulate the heat transfer conditions of hypersonic flight of missiles and satellites.

Other scientific disciplines undergoing investigation include: high temperature chemistry, hyperthermal gas dynamics, high intensity radiation in the visual and near visual spectrum, plasma physics and electro-magneto fluid dynamics.

Our staff will be pleased to perform hyperthermal tunnel tests for you at our facility, or install a complete hyperthermal tunnel at your plant.



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ENGINEERING REPORT ON BENDIX COMPONENTS



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SHOWN with status indicator, lightweight (13 oz., including entry selector switch which is not shown here) and compact (2 in. dia., 1.5 in. deep) can monitor five areas of a system on one die through multiple transducers. That does only critical (highest or lowest) measurement entry selector switch or lighted panel with assembly then reveals which transducer is giving that measurement.

Multi-Scan Indicator Monitors Five Areas

New York—Multi-transducer indicator, which can monitor five or more critical points on engine, temperature, of pressure or hydraulic systems, and send out only the critical (highest or lowest) measurements on one die, has been developed by Bendix Precision Products, Inc., Tarrytown, N. Y. Visual Command helicopter uses a Bendix multi-scan indicator to check engine oil pressure at fore, aft and middle gear boxes, left and right engine oil pressure.

The unit composed of an indicator, amplifier, transducer bridge and entry selector switch, operates automatically. Signals from the transducers are over-coded with fixed reference voltage in the bridge, differences in phase and magnitude are amplified to drive a two phase motor, which in turn moves the indicator pointer on the face of the dial.

Indicator shows shows the highest (or lowest, depending upon the system being monitored) which is displayed by the various sectors in the first model built by Bendix, a status selector switch is operated manually through five steps and at each step, which is keyed to a specific transducer, the pointer indicates the measurement being taken by that sensor.

The step at which the highest (or lowest) reading occurs is the critical area in the performance of that system and the pilot must then take appropriate action.

The second version of the unit has a button panel, which lights behind the nucleus of the system Model in operation is identical with the first model, with the exception that panel manually light automatically to indicate the critical transducer.

000018 FILTER CENTER 000003

► **Integrated Computer Elements Out**—First in a line of integrated digital computer circuits called Micrologic elements (AW page 11, p. 94), was announced as commercially available last week by Fairchild Semiconductor Corp. Micrologic elements are silicon chip devices with junctions and contacts defined into them to form a single circuit function. These integrated circuits currently are based on a silicon version of a conventional transistor TOS-1 leader and contained within a TO-5 case. First element containing the equivalent of four transistors and two capacitors is a logic flip-flop, priced at \$820. It will be followed shortly by a gate element, then four other units: a shift register, counter decoder, buffer and buffer-holers (the use of all the rest). Later products Micrologic lines will be sequenced into the smaller transistor TO-18 case.

► **Douglas Announces Expansion Delayed**—Bendix in Douglas Aircraft's efforts to acquire a "technical system" in the field of electronic systems, the T-10, the company's latest bid does not stop the almost inevitable discontinuation of this computer line manufacturer's line of systems. Douglas is steadily increasing its in-house systems capability. No fewer than five departments in its Missile and Space Systems Division now have special groups studying possible advanced special systems products. The company also is expected to have purchased, related acquisition with several divisions from recently Negotiations to buy into Malvern's wire transmission, Douglas has, when the T-10 products of receiving and data processing gear arranged a \$4.5 million loan from Malvern Technical Development Corp.

► **TV Guided Air-to-Surface Missile**—An air-to-surface missile, which could look as a TV or video image of a target in order made by the Ballistics Division of Singer Corp. Pilot would select target visually as from TV display and automatically receive visual image in this. Do. If the airborne vehicle were photo, a battlefield command center might select target from TV image relayed to him from the drone. Possible re-attack of the target could be made by the Navy's Bellhop might be in greater accuracy and to control accurate image from him back to its missile impact.

► **Protonic Digital Computer-Ken**—Ken is developing a protonic digital computer, expected to be capable of performing such functions as in a elec-

tronic machine over temperature range from -100° to 1,000°. Kenark has developed a protonic flip-flop which has a switching time of only 10 microseconds, operating above 100,000 cps or gm. Kenark reports that it can package 2,000 such flip-flops in a volume of one cubic inch, including all microconnections. On this line, Kenark is developing a protonic analog and a protonic digital computer, complete with memory in a two cube.

► **Transistor Sales Reported**—Semiconductors industry has sold 11.1 million transistors in November, an increase of 50% over unit sales in November of previous year. Dollar value of November shipments was \$35.4 million, an increase of sales 12% over previous November, reflecting lower unit price, according to figures released by Electronic Industries Association.

► **New High-Power Transistor**—A 75 kw. temperature-stable transistor, developed by Radio Engineering Laboratories, is expected to permit 400-500 hp long pulse between transistors, roughly twice the output of most existing tube systems. Company says the amplified power of the new transistor is seven times that of any TMI input transistor ever built.

► **Signal on the Dotted Line**—Major radio wave signals are measured by various manufacturers include the following:

- **Remington-Rand, Union**, \$13.6 million Navy contract for production of peripheral equipment for Naval Data Systems and continuing work on computer programming and system planning.
- **Remington-Rand, Union**, \$71.6 million Navy contract for production of peripheral equipment for Naval Data Systems and continuing work on computer programming and system planning.
- **Westinghouse Electric Corp.**, reports contract for \$1 million from Boeing for electrical systems to be used in new 737 jetliner transport.
- **Cole Electronics, Mass.** division, Hingham, Mass., \$2.5 million contract from Columbia University for production of new high power laser transmitters for use in long-range submarine detection system.
- **Sperry Gyroscope Co.**, \$13.5 million contract from Bell Telephone Laboratories for development and construction of high power transmitters to be used in communications order of Nike Zeus anti-ICBM missile system. Sperry developed Nike Zeus target tracking radar under an order \$7.5 million contract. Company also has secured a \$100 million from North American to develop and manufacture a two-way radar platform to serve as a target and control reference in the B-70.

ENGINEERED REPORT BY WARE REPORT COMPONENT PACKAGE

CAM COMPENSATOR

Offset compensating device for curve system axes.



The type CM-20-A is a simple, sturdy mechanical device of covering an output gear that is driven by either curve loop axial, among others, or from conventional systems. The system is designed for use in a wide range of applications. Ask for full details.

CONTROL TRANSFORMER

Changes mechanical differential inputs to electrical outputs.



Model is a two-stage transformer unit that features a variable loading mechanism along with a standard synchronous motor. Because loading, as well as speed, can be varied, an additional output can be obtained into control system. Because loading assembly is driven by a gear mechanism, the transformer can be used to convert inputs into electrical outputs.

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(Continued on p. 12)

Announcing a new ultra high-speed computer
in the PHILCO 2000 series



MODEL
212

**Faster than any other
Data Processing System
now installed
... even four times faster than previous
Philco 2000 Systems**

Philco 2000 Data Processing Systems have always been among the fastest and most reliable. Now, the new Model 212 Central Processor brings an entirely new concept in data processing speed, efficiency and flexibility to business, industry and science.

Advanced flowchart processing, which permits simultaneous processing of four individual data flow charts, with double instruction logic, improved external organization, all contribute to the tremendous speed of the 212. Four times faster than any previous model. For example, it can perform 625-640 additions in one second.

Faster running time, more efficient use of memory and reduced programming time, result in the greatest possible increase in data processing.

The 212 Central Processor is fully compatible with all Philco 2000 systems. You can install a Philco 2000 system now, replacing either the Model 210 or 211 central processor, and as your work load increases, replace the central processor with the Model 212. Without reprogramming! Write today for complete information.

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RCA Develops Test Module Family

By George Alexander

New York—Building-block family of interchangeable test equipment modules, which can be added or subtracted to form complex or simple systems, has been developed to handle 94% of all standardized tests on electronic units, ranging from computers to complete assemblies.

The modularized test DDE (Digital Diagnostic Equipment) family was developed by Radio Corp. of America, Camden, N. J., in an outgrowth of an Army contract in 1959 for a test and checkout system capable of maintaining the electronic assemblies of Nike Ajax, Nike Hercules, Lance, Sergeant and Hawk missile systems.

New software called "Control-Rules DDE" is RCA's answer to this, a built-in simulation system, consisting of 10 racks of equipment. After then asked RCA in 1963 to develop a failure system with the same multi-purpose test capability, but smaller in volume, lighter in weight and operable from a 24 tes track.

Computer-controlled DDE uses RCA's software and the other, simpler systems evolved from this.

Four Configurations

RCA is presently offering Digital Diagnostic Equipment in four basic configurations, which can be tailored to fit individual requirements.

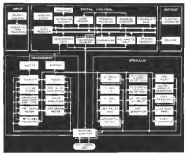
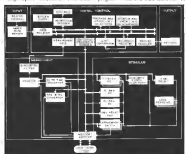
• **Programmed Semi-Automatic:** Designed to be tested with the user's present test module greater simulation and measurement equipment, this simplified test DDE operates from a low-speed preprogrammed paper or Mylar tape. System consists of a tape reader, control and display panel and measurement module for each under test. Control module has a data register, internal to-beam coded decimal encoder and switching. Test results are printed out and usually compared with standards in a separate. Application of this system, restricted to one rack, would be in production line testing of electronic components or component grading and selection.

• **Programmed Automatic:** Operating from high-speed preprogrammed tapes, this system uses three 200 test modules (equal to 11 diagnostic routines or 86 acceptance tests) on one 10-in. tape reel. Like all DDE systems, selection of measuring points and measurement functions are automatically and remotely controlled. Measured values are compared with upper and lower test limits and each value is printed out with a HI, GO or LOW symbol keyed to a test number. Output from

reading will stop the test routine and automatically lock on a fault routine, diagnose subsequent tests on tape to locate and identify the trouble. Switches, on 14 racks, is designed for acceptance and diagnostic testing.

• **High-Speed Automatic:** This DDE

uses general-purpose computer elements (arithmetic logic, level one processor, etc.) to control test modules, simulate inputs and results processing. Paper tape reader or magnetic tape with buffer memory unit performs limit comparison, test program search and fault isolation. It



PROGRAMMED AUTOMATIC DDE (top) and Computer Controlled DDE (bottom) reveal strong family resemblance, showing same standard interchangeable modules. About 94% of all standard test routines run on electronic units can be performed with DDE modules; special modules (such as digital storage processor) are needed only for particular tests.

NEW AVIONIC PRODUCTS

addition to the analog circuitry, often includes a digital storage processor for testing and checkout of digital devices (such as airborne computers). Applications of this DEE, in one mode, model for on-line production and quality control lines, where repetitive high-speed testing is required.

•**Computer Controlled.** Using some hardware and techniques of high-speed logic volume data processing, this system stores test instructions and gives cues on magnetic tape. Arithmetic computations are performed by an electronic unit from data stored in a high-speed opticon plane storage unit. A fault-tolerant watchdog monitor is used instead of an end-of-test and points out measured values in an electronic recorder. This 51-bit system can be used for production testing, field checkout, depot maintenance or research and development testing criterion.

Key to the control unit is every DEE, return to the "data bus"—a bus—a communication circuit for digital signals throughout the controller.

In addition to retransmitting the data and instruction register, the unit auto, compare, switching control and when required) success status; i.e., the data bus also links peripheral equipment, such as typewriter and data printers, to the act of the DEE system.

•**Manuscript triggered spark gap.** Type Z 1562, for switching single contact electrical energy into low-impedance load, such as multiple explosive bolts, can handle 15 joules of energy at 5,000 v., switching in 1.0 to 0.5 microseconds.



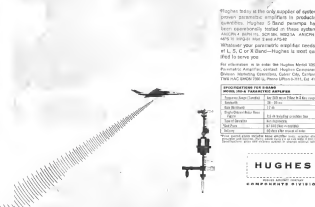
The second ceramic tube can withstand shock of several thousand g forces for several milliseconds and operates over temperature range of -65F to 200F. Device measures 9.7 in. diameter and 13.5 in. long, weighs 0.3 oz. Manufacturer: General Electric Co., Tube Dept., Schenectady, N. Y.

•**Variable phase shifter.** Model G181, can provide phase shift ranging from zero to more than 180 deg. over frequency range of 5,500 to 5,750 mc.



with insertion loss of only 0.6 db. The phase shift is controlled by applied voltage which ranges from 0 to 25 v. At constant control voltage, phase shift setting is maintained within 5 deg. over temperature range of -50C to 05C. Power handling capability is 10 kw peak and 30 w average. Manufacturer: Canada Research Co., Canada Electronics Corp., 1241 San Francisco Rd., West Los Angeles.

•**Pneumatic motion actuated gya (PRAGL) Series 30,** a miniature, low-cost gas-operated transducer gya, includes miniature measuring feature which permits operation not without measuring gya from which. Gya will operate on either dry nitrogen or dry air, pro-



SPECIFICATIONS FOR 5-BAND HUGHES 5-BAND PARAMP RADAR	
Frequency Range (Control)	5 to 100 mc. (Band 5) 10 to 100 mc.
Bandwidth	20-30 mc.
Scan Rate	12-14 sec.
Display (Control Room)	100 ft. x 100 ft. (Control Room)
Size of Antenna	400 sq. ft. (Control Room)
Weight	100 lbs. (Control Room)
Power	100 kw. (Control Room)

*These figures are typical and are subject to change without notice. Specifications given are subject to change without notice.

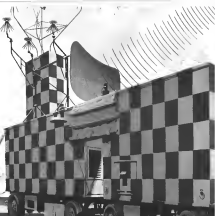
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COMPONENT DIVISION

HUGHES "PARAMPS" EXTEND RANGE OF GCA RADAR BY 50%

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Hughes Paramps increased radar range by 50% and radar altitude coverage by more than 400%.



vide low-level altitude reference for four reaches of continuous operation, up to 6 sec. with same loss of accuracy. Gya weighs less than 3 lb., measures 7.5 in. dia. by 14 in. long. Standard units come with potentiometer pre-bolt, but other types are available. Manufacturer: Sargent Associates, Inc., Instruments Div., Nesham, N. H.



•**Flexible signal generator,** Model 22/U, provides FM and unmodulated RF signals. One of two output coils supplies output voltages in nine different output controlled frequencies corresponding to needs and wire module frequencies. The other coil supplies RF output signals in frequency range of 20 to 100 mc. in five bands. RF output is variable, 0.5 to 100 v., RF output, 0.07 to 10,000 microamps. Manufacturer: Systems, Inc., 2400 The United Way, Glendale, Fla.



•**Low-level altitude reference unit,** Type Z-1562, for use in the T-10 low-level altitude reference unit is designed to withstand the shock and vibration. The unit's control unit has more signal loss than 16 db., maximum gain of 25 db. and power output of 5 w. across the band, depending in manufacture. Tube is supplied in complete package including permanent mounting supports. Weight is 118 lb. Price is \$2,850. General Electric Co., Power Tube Dept., Palo Alto.

•**Digital buffer storage unit,** Model 1720 provides isolation and storage in most variety of digital measuring in



struments and associated printers, gauges or other output devices. Device accepts either decimal or binary coded decimal information in the form of voltage drive or contact closure and provides isolated digital control channel outputs. Data input transfer rate is as low as 100 microseconds and output control channels across field until wait or provided. Model 1720 has storage capacity of 8 decimal digits and is fully transistorized. Manufacturer: Auto Data, P. O. Box 9146, San Diego.



•**Illuminated multi-switch,** Series 21000, is available with up to 17 stations, and in three different operating voltages, 6.1 dc., 28 v. dc. and 115 v. a.c. Serial rows of switches can be ganged together and provided with interlock action between all buttons. More than one station switch can be depressed at a time or locked but can be provided to prevent depressing more than a single switch. Manufacturer: Switchcraft Inc., 1551 N. Elston Ave., Chicago 30.



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FINANCIAL

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Wage and Whole Expense, Inc., Ithaca, N.Y., engaged principals in the business of freight forwarding by air. The company also provides "terminal handling" service at Chicago. Offering is 95,000 shares of common stock, for public sale at \$1 per share on an all-or-none basis offering this includes 10,000 shares of common stock and 54,000 in view warrants to purchase a like amount of common stock at a premium rate of from \$3 to \$5 per share, which were sold to the underwriters and others for an aggregate of \$11,400. Of the proceeds, \$94,400 will be used for the expansion of the company's existing service organization of its sales force in the present 42 geographical areas of service expansion and modernization of facilities for handling air freight shipments; balance will be added to working capital to finance accounts receivable and for general corporate purposes.

Wellard Aircraft Service Equipment, Inc., Miami, Fla., engaged in the manufacture and sale of a wide variety of ground, field and transport equipment used to service commercial and military aircraft. Offering was 115,000 shares of common stock for public sale at \$4 per share. Of the estimated net proceeds \$100,000 will be used for a proposed new plant, \$55,000 for new machinery; \$3,500 for moving expenses; balance will be added to the general funds to working capital.

Consolidated Airborne Systems, Inc., New York 24, N.Y., engaged in and is primarily in the design, development and production of prospective devices in the field of electronic and cryogenic ground support equipment and airborne instrumentation for the military and commercial aircraft industry. Offering is 150,000 shares of Class A stock for public sale offering price and underwriting terms to be supplied by prospectus. Of the proceeds \$12,000 will be used for the equipment of notes issued in certain former and present officers, directors and Class B stockholders (the proceeds of which sales were used for working capital), to repay bank loans of \$10,000, for research and development and expenses of manufacturing facilities and for working capital.

Vacuum-Electronics Corp., Plattsburgh, N.Y., engaged in developing and producing various kinds of high vacuum and related test detector systems, and also sells vacuum components and accessories for such systems. Offering is 140,000 shares of common stock for

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- Aircraft Flight and Electronic Systems—Largest supplier of airborne centralized flight data systems; also working with other electronic controls and instruments including engine and electronic applications.
- Missile Systems—Largest supplier of accessory power units; Aerospace is also working with hydrogen, jet gas and hydrogen systems for missiles, liquid and gas cryogenic valves and controls for ground support.
- Gas Turbine Engines—World's largest producer of small gas turbine engines, with more than 9000 delivered in the 30-500 hp class. Studies include turbofan and nuclear applications.

Excellent positions are available for qualified men with M.S., Ph.D. and Sc.D. degrees for work in these areas.

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Bendix-Pacific Division
NORTH HOLLYWOOD, CALIF.

public sale, offering price and underwriting terms to be supplied by underwriter. Of the proceeds, \$1,166,000 will be used to retire outstanding loans incurred in connection with the acquisition of land in Phoenix and construction of plant and office facilities will be added to working capital and used for general corporate purposes.

Digitec Corp., Abington, N. Y., presently engaged in the design, construction, sale or lease, installation and maintenance of electronic digital systems, and the design, manufacture and sale of electronic components for data handling and the processing. Offering is 30,000 shares of capital stock for public sale, offering price and underwriting terms to be supplied by underwriter. Up to 10,000 of such shares may be sold for the satisfaction of one or more purchases designated by the company at the public offering price, less an underwriting discount. Offering also includes 54,950 outstanding shares, which are part of 150,000 shares which had previously been owned by the four managers of the company and which were acquired by certain investors in Sept. 1973, and may be offered to take back here to here in the future.

Of the proceeds, \$200,000 will be used to retire short-term bank loans; balance will be added to general funds to be used toward financing new product development and the cost of repairs not available for use to investors and for additional working capital.

Klein Electronics, Inc., Silver Spring, Md., a national electronics engineering and development and production of optoelectronic equipment for use in modern communications, instruments, test data processing and other electronic systems. Offering is 115,000 shares of capital stock for public sale, offering price and underwriting terms to be supplied by underwriter. Proceeds will be used to pay, on hand, on debt of \$162,172 and creating a fund to pay to James E. Haffa, president, of \$45,000; the balance to be added to working capital for use in connection with the company's expansion plans. It is expected that \$166,000 will be applied to further research and development relating to navigation products, \$78,000 to finance expansion of the marketing program, \$50,000 applied to the purchase of shop, technical and other capital equipment needed in connection with the proposed new plant facilities; the balance to strengthen the company's financial position to permit it to accept new orders in connection with the expanded production and distribution of certain project-on products.

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- **STRUCTURAL TEST AND ANALYSIS**—Knowledge of the static and the fatigue strength of materials and structures, and theoretical and experimental stress analysis techniques. Responsible for evaluating stresses in structures and relating them to the fatigue strength and other mechanical properties of materials. Must predict the ability of structures used in equipment for high speed service and evaluate its function successfully in their service environment.
- **PERFORMANCE ANALYSIS**—Requires aptitude for analytical work in one or more of the following fields: Aerodynamics, thermodynamics, heat transfer, hydraulics, and fluid dynamics. Encompasses both theoretical analysis and interpretation of test results associated with design and development of turbo-propellers, jet aircraft and engine components including small turbines, compressors, pumps, fans, heat exchangers, and controls.
- **PROCESSES** involve development and application of advanced analytical performance methods, defining functional configurations of product components and computer systems to meet specifications, conducting system dynamic control analyses to ensure proper stability and response characteristics. Advanced digital and analog computers available in present application of complex methods of analysis.
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HAMILTON STANDARD DIVISION
DIVISION OF UNITED AIRCRAFT CORPORATION
Bridley Field Road, Windsor Locks, Connecticut



SECOND prototype of Mooney-Buchler MS-88B Rallye is shown in first flight Feb. 30. Plane is powered by a 100-hp Continental engine. The No. 1 airplane will be sent to the U.S. for demonstration purposes. Modified design for first Rallye is its overhauled tail.

French Rallye to Be Assembled in the U.S.

By Herbert J. Coleman

Mooney-Buchler Rallye single-engine lightplane will be assembled in the U. S. this year as it determined by the French manufacturer to capture a share of the American business plane market.

The airplane has already developed a marked interest in European markets (AW Sept. 1, p. 92). Last month, Mooney-Buchler had 166 firm orders, of which 85 came from 17 foreign countries. France is asked in those terms.

• Rallye 960, powered by a Continental C96 140 hp engine. The U. S. price is \$5,710.

• Super Rallye 888, powered by a Continental D-200A 100 hp engine, priced at \$5,999.

• Rallye 885, powered by Continental C130A engine delivering 145 hp. Price will be \$5,995.

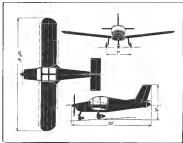
Mooney-Buchler has completed a license agreement with Caltech Aircraft Corp., Menlo Park, Calif., a new company headed by P. M. Coleman, Orleans, Ill., who also is president of Midwest Aircraft Sales and managing director of the Trans-Atlantic Division of Kappa Aerospace, Ltd.—British-owned flying company.

Coleman and Caltech Aircraft will

assemble the Rallye at a newly acquired production site at Menlo Park Airport. Engines will be delivered on the spot by Continental Motors Corp., which builds them at Muskegon. All major surface components will be built in

France and airframed to Menlo Park for assembly and engineering test flights.

By the end of this year, Caltech Aircraft plans to have at least one Rallye in more state, for sales and



RALLYE carries 26 gal. of fuel and has a gross weight of 1,708 lb.

demonstration purposes. Company now is setting up dealerships. Usually present prospects, Coleman said, the firm will assemble up to 50 Rallyes a month in 1982.

First U. S. Rallye will be the No. 3 prototype, MS 885. The airplane will be delivered to Menlo Park on Apr. 1 and later will participate in a national demonstration tour.

The original prototype has flown more than 1,000 hr in various operating regimes, ranging from Scandinavian mountain flying to African jungles. By now Mooney-Buchler plans a new engine run of 10 Rallye's in a modified high-lift production site near before production in France.

The second prototype differs from the first (AW June 28, p. 277) through the addition of a new tail, an extended canopy and a larger cabin for three passengers. Landing gear also has been fixed over and control sticks have been replaced by wheels.

The airplane, designated Caltech Rallye for the U. S. sales, was undergoing Federal Aviation Agency and French government certification in France. Plans have been dropped to Civil Air Regulation Part 1 requirements. A new design will be known as "Rallye" category, at full gross weight and "automatic" with two persons aboard.

Coleman said the airplane features automatic wing flap in retract, eight speed brakes, McCulloch 25-watt propeller is standard equipment, as are brakes and power, retractable panel. Also standard is automatic feathering tail, standard six engine is at the prop.

Caltech Aircraft Corp. recently plans to handle distribution of the Mooney-Buchler Rallye 760, a lighter powered version of the MS 760 two subject (AW May 25, p. 33). Berch Aircraft has covered plans to sell the jet, but still has the demonstrative. New version will be powered by a 100-hp engine. Mooney-Buchler and Coleman is undergoing certification with French design plans call for development of a seven-passenger version of the 760/760 jet and sales, according to Coleman. He said Mooney-Buchler also is considering a two-engine version of the 885/885 Rallye series.

The Rallye and Super Rallye both carry 26 gal. of fuel and have gross weights of 1,708 lb. The MS 885 carries 44 gal. of fuel and gross weight is 2,700 lb. Plane lands at 95-100 mph and maximum has winged standard conditions, as level wings from 871 mph for the Rallye 885, 328 mph for the Super Rallye and 145 mph for the Rallye 885. Cruise speeds (standard conditions at 2,670 ft.) range from 106 mph for the 885-hp version to 131 mph for the 145 hp model.

Length is 25 ft. and wingspan is 33 ft. 6 in., with a wing area of 152.5 sq. ft. Rallye is 9 ft. high (tail to ground) and runs gear spacing is 7 ft. The engine rates is 7.57 and takes weight is 4 ft.

Coleman and Caltech will be added to the 50,000 sq. ft. of production plant space for servicing. Semi-Air Division has letters forward to distribute Caltech products in the Menlo Park area, and to provide facilities for pilot training and refueling. Parts direct will be opened later.

Associated with Coleman in Caltech Aircraft are W. J. Sauter, Director, IT, vice president, owner of Sales Plans, Inc., Glendale; a photo-finishing laboratory; K. C. Davis, River Forest, Ill., aviation; Sauter's associated with Lake Shore Imports, Kew-Forest, California, and M. H. Coleman, treasurer, president of Concorde Services, Inc., Martin Grove, Ill.

Howard to Head Army Technical Committee

National Astronautical Services Assn., Washington, D. C., has named Beverly E. (Evelyn) Howard chairman of a Technical Committee on Army Aviation. Howard is president of the American School of Astronautics, which conducts Army flight training at Ft. Belvoir, Mo. Other members are M. Ransom, Director of Astronautical Services Assn., Co. (helicopter school), Camp Roberts, Wis.; Roy H. Madsen, vice president, Aerospace Industries Assn., Wash., D. C.; and W. T. Neel, general manager, Ft. Belvoir Division, the Helicopter School, Ft. Belvoir.

Committee will meet during the annual convention Apr. 11-14 in Washington. It was formed at the suggestion of Maj. Gen. Richard D. Meyer, Army deputy chief of astronautics (Aviation) to offer technical transfer in studying specific Army aircraft requirements problems.

PRIVATE LINES

Cessna Model 185 Stinson has secured its Federal Aviation Agency aircraft type certificate.

Piper Aircraft Corp. shipped over, that \$6 million worth of its line of business planes to various dealers last year. Actual selling was \$6,045,678, against \$2,002,996 the year before. Most two-passenger planes were flown to their destinations. Total of 58 cars were delivered Piper airplanes.

James C. Buckley, Inc., industrial and transportation consultants at 30 East 48th St., New York City, has estab-

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The Applied Physics Laboratory
The Johns Hopkins University

3431 George Avenue, Silver Spring, Md.
(Suburb of Washington, D.C.)



Said Hans Oersted: "When a conductor carries current through a magnetic field at right angles to it, the resultant reaction thrusts the conductor in a direction perpendicular to both the current and the magnetic field."

A light-weight, low fuel-consuming propulsion system is a primary requirement for interplanetary space vehicle travel. One such system now being carefully studied utilizes plasma propulsion.

This concept employs an electrical field to produce a plasma and to inject it in a magnetic field then ejects the plasma, thereby providing a reactive thrust to the vehicle.

Plasma propulsion is but one of many subjects under investigation at Lockheed Missiles and Space Division. Outstanding facilities, equipment and scientific personnel mark the organization as eminently capable of exploring many unusual aspects of space travel. This, coupled with Lockheed's favorable locations in Sunnyvale and Palo Alto on the beautiful San Francisco Peninsula, considerably attracts scientists and engineers interested in pursuing work in their special fields.

Why not investigate future possibilities at Lockheed? Write Research and Development Staff, Dept. W-25A, 662 West El Camino Real, Sunnyvale, Calif. U.S. citizenship or existing Department of Defense industrial security clearance required.

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Added a special section to provide technical analysis for companies operating or interested in operating business aircraft. Aeronautical, under direction of John C. Lambert, are equipment evaluation, fleet management, base location and cost analysis.

Spartan Air Services, Ltd., Toronto, Ont., has signed a contract for \$405,000 for air survey and mapping work in the province of San Luis, Argentina. Agreement was made by Spartan's locally formed Argentinean subsidiary, Baromet Aero.

Flightcraft, Inc., Portland, Ore., has purchased Georgia Air-Masters, also of Portland, an FAA-approved instrument and aircraft repair shop. Company will be operated as a Flightcraft Division with founder C. F. Perrotti as shop manager.

Lake Aircraft Corp., builder of the Lake L-4A Amphibian, has set up, at its plant on a 20,000 sq. acre site, the new base of South American contract Pilot in Cuban Territory. Francisco Loharte of Air Canada Service Corp., Washington, D.C., will handle sales in 77 cities listed.

Grain Aircraft is shipping 17 single-engine business planes, built from New Orleans, La., to Ben Arusha (P.O. Box 1) at Bunkwina, NRD. Australia Shipment to its Australian distributor in north area, about \$500,000.

New helicopter charter service, Delux-Helicopter Sales & Service, Inc., has been established at Manila, Mo., utilizing a Hiller 12F and 12C Coaxial, headed by Willis H. duPont, also operates duPont Aeronautics, a fixed-wing charter service.



The Lincoln Laboratory, Massachusetts Institute of Technology, announces a major expansion in its program. We urgently request the participation of senior members of the scientific community in our programs in:

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A more complete description of the Laboratory's work will be sent to you upon request.

Research and Development

LINCOLN LABORATORY
Massachusetts Institute of Technology
BOX 20
LEXINGTON 73, MASSACHUSETTS



WHO'S WHERE

(Continued from page 19)

Honors and Elections

Mr. Gen. Albert Ford (USAF ret.), ex-president and general manager of Westinghouse Electric Corp's Defense Products Division, has been awarded the company's Order of Merit for "years and leadership which have inspired thousands of Westinghouse's finest engineering and design and space products."

Frank L. Dahlen, director of material for Boeing Vertol, Co., has been elected chairman of the Materials Procurement Committee for 1981 of the Aerospace Industries Assn. and **W. R. Kuttig**, aircraft materials manager of Vought Aircraft Industries Division of Chrysler Vought Corp., was elected vice chairman.

Stanford Professor Howard E. Sedlet has been elected to the Engineering Academy Section of the International Academy of Astronautics.

Changes

Roy H. McGee, manager national air maintenance, Boeing Aircraft Corp., Wichita, Kan. Office Branch, will be replaced by **C. Noland**, regional sales manager for the RTO short lead program. **Gerald R. Jorg**, executive project administrator, military projects, T. E. Mather, regional office manager for the N8125-1/Q-12, major repair.

Ray E. Waselek, public relations director

Hamilton Standard Division of United Aircraft Corp., Waltham, Mass., has been transferred to United Aircraft.

James E. Dore, chief Air Traffic Control and Navigation Branch Systems Engineering Division, United Aircraft, Aircraft's Bureau of Research and Development.

Ken Allen Harris C. Eberlin (DAF ret.) director, Plant Communications Division, Alpha Corp. Dallas has been a subsidiary of Collins Radio Co.

William T. Bismarck, chief engineer, Ryan Aeronautical Co., a subsidiary of San Diego, Calif.

Dr. Jack E. Froelike, general manager of the newly created Applied Sciences Division of Space Electronics Corp., Glendale, Calif.

Dr. Maxwell Dunn, principal staff scientist, Plans & Programs Division, North American Ind., Cockeville, Mo.

Robert W. Lewis, chief engineer, McCord Ship Systems, Hollister, Calif.

Edward A. Fisher, manager industrial materials, General Electric Co., Light Metals Division, Department One, N. Y.

John W. Robinson, advertising and public relations manager, Lockheed Instrument Corp., Elmhurst, N. Y.

Dr. Bruce A. Gergen, director advanced projects, Genl. Technology Center, Texas Instruments, Dallas.

Dr. Philip H. Brandt, director research and development programs, Aerojet General Corp., Azusa, Calif.

Walter B. Bensen Jr., assistant general manager, Engineering Division, Aerospace Corp., El Segundo, Calif.

William H. Foster, manager, Advanced Technology Department, Advanced Electronics & Information Systems Division, Ford's Defense Systems, San Francisco, Calif. and Keith L. Wines, manager, Advanced Electronics Department of the division.

William R. Feltman, chief production engineer, Manufacturing Corp., Wichita, Kan. Division, Vero, Calif.

Edward D. Ryan, marketing services manager, Instrument and Diagnostic Group, Verne, Los Angeles, Palo Alto, Calif.

Roger B. Rosen, manager, Program Analysis Technical Staff, Ford Vertol Co., a subsidiary, Division, Aircraft, Bush, Calif.

John H. Rosen, chief engineer, Electronics Development Engineering Computer Products Division, Aeroflex.

Richard D. Menniger, general engineer, C. I. Schmitt Co., Norwalk, Conn.

George E. Hadden, in charge of R&D/ROD and Radio Production Planning and Control, Coulson Aircraft Corp., St. Louis, Mo.

Thomas M. Gray and **Henry H. Nott**, responsible for planning and processing functions.

David A. Redding, manager, Technical Development Corp., El Paso, Texas. See **Refuel**, Calif.

Dr. Louis A. Caspell, has joined the Research Division of General Dynamics Electronics, Rochester, N. Y., he will be responsible for technical issues within the division and with other divisions of General Dynamics.

Joseph F. McCadden has been appointed to the Washington D. C. office of Collins Radio Co.

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Minimum Requirements: B.S. degree in Aeronautical or Mechanical Engineering and applicable experience.

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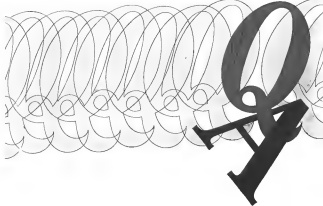
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